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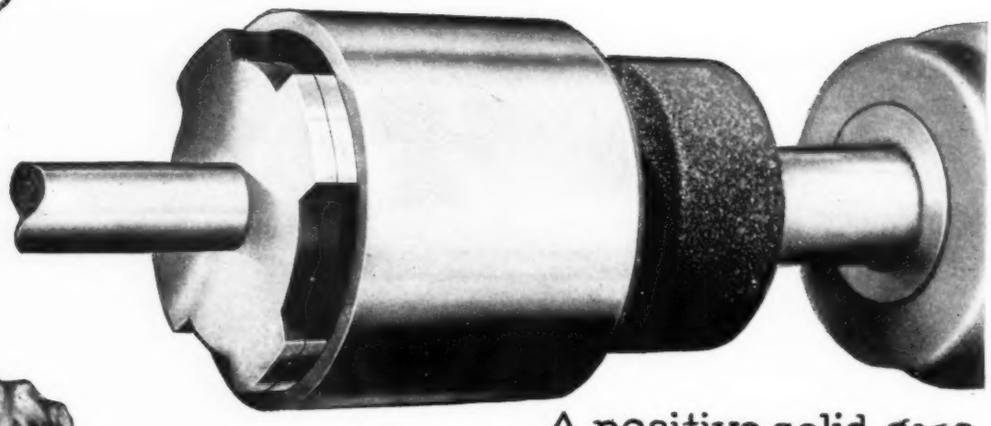

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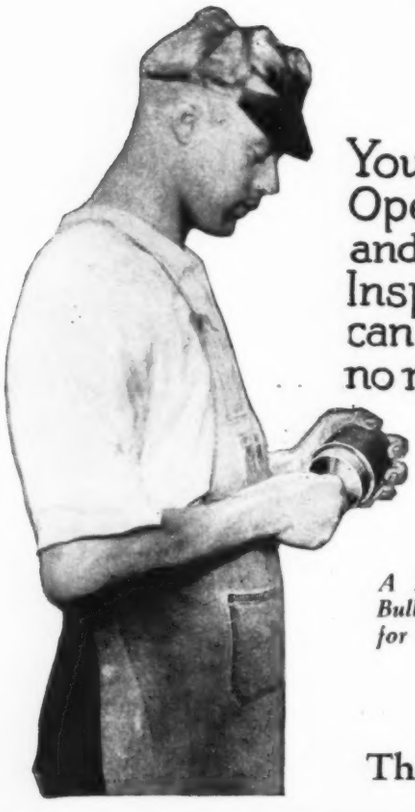

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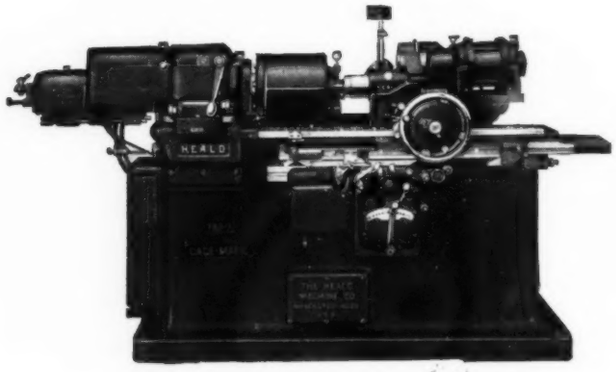

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What the Machinery Industries Mean to America

QUITE a number of sentimental writers raise the wail that machinery kills all the joy of craftsmanship out of the working man's life. But the same writers would hate to give up the luxuries that they now enjoy and which they could never get from a handicraft industry.

SOME politicians raise the cry that machinery causes widespread unemployment. But the same politicians complain loudly against the high cost of living. What would our present comforts cost if we had to buy everything hand-made instead of machine-made?

THE ordinary man thinks too little about what the machine industries have done and are doing to improve the living conditions of the nation.

ISN'T it about time for all the machine industries to make the nation understand what the Machinery Industries mean to America?

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American Machinist

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Conversion of Hardness Numbers

By ALFRED HELLER
Secretary and Treasurer, Hercules Electric Steel Corporation

Present tables for converting from Brinell to Rockwell, although reasonably accurate for the "B" scale, differ by as much as ten numbers on the "C" scale

DURING the past few years the Rockwell hardness tester has become quite generally used, and many plants equipped with the Brinell have added the Rockwell machine because of its ease and speed of application. Consequently, there has been an increasing demand for a reliable conversion table for the two systems, and numerous tables have made their appearance.

These tables check up quite well as far as the Rockwell "B" scale is concerned, but there are decided discrepancies when it comes to the "C" scale. This is to be regretted as the "C" scale covers the range from Brinell 244 (C-20) to Brinell 740 (C-68), and therefore includes practically the entire range of heat-treated steels where the most exacting requirements as to hardness values are met. A comparison of the last four conversion tables appearing in the *Transactions of the American Society for Steel Treating* shows a variation of some ten Rockwell "C" numbers at C-20 and about five at C-60. In order to get a variation of five numbers at C-60 it would be necessary to vary the temperature of tempering some 275 deg. F. in the case of a standard water-hardening tool steel. A variation of this magnitude could not be tolerated at any plant doing careful work. For example, an examination of taps made by a well-known manufacturer showed a variation of not more than one-half a degree in Rockwell "C" hardness from a given average of about C-61.5.

To illustrate the importance of duplicating hardness exactly by correct and careful heat-treatment, a description of the performance of a swaging die used in a toggle-joint press for cold swaging nickel silver might be of interest, together with the successful heat-treatment finally developed. Nickel steel is naturally rather soft, but quickly hardens and toughens under cold working so that dies made to cold forge the same are very apt to "sink" (become permanently deformed in direction of the pressure). If they do not sink, they often crumble at the edges of an impression. The die in question was made of 1.10 per cent carbon tool steel of a good grade. Ordinary heat-treatment, that is hardening at 1,450 deg. F. and drawing at 450 deg. F., resulted in the die quickly sinking in operation. Lowering the drawing temperature cause no improvement. Therefore, to increase hardness penetration a a quenching temperature of 1,500 deg. F. was tried, using brine as a quenching medium. The die was then slowly drawn in liquid salt at 350 deg. F., held for 15 min. at this temperature, and air cooled. Production was immediately increased to 10,000 pieces before the die "sank." The hardening temperature was then gradually increased from 1,500 to 1,550 deg. F., and the time of soaking at the hardening temperature from zero to twenty min. The drawing temperature was held constant at 350 deg. F., and the time of drawing at 15 min. The best combination for hardening was found to be ten minutes soaking at 1,550 deg. F., the production being 20,000 pieces.

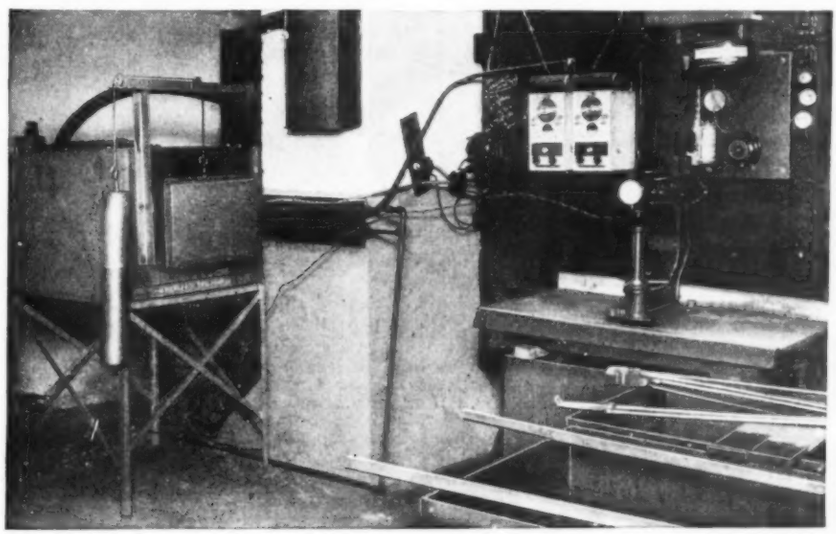


Fig. 1 — Furnace and automatic controls used in preparing the samples for the hardness tests

Holding the time of tempering constant, the temperature was varied up to 425 deg. F., and the best combination of tempering was 15 min. soaking at 400

The first part of the article. The second part will appear in an early issue.

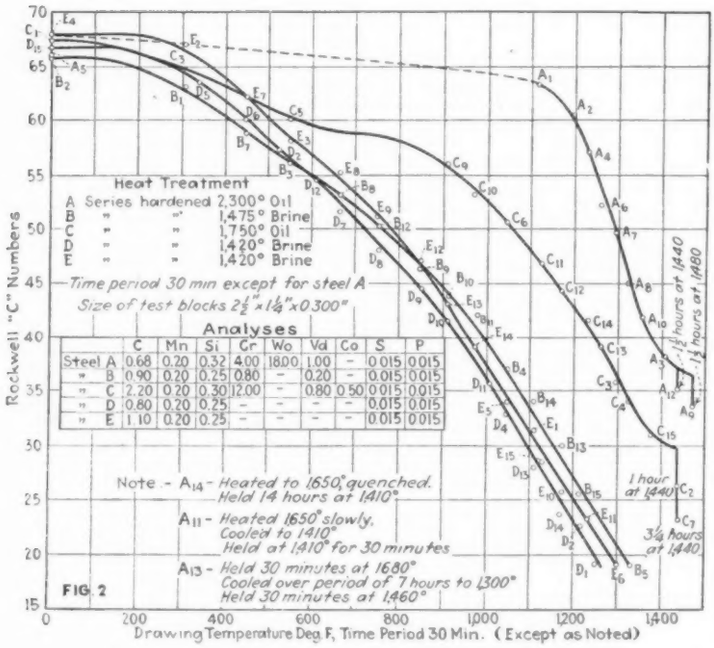

Heat Treatment
A Series hardened 2,300° Oil
B " " 1,475° Brine
C " " 1,750° Oil
D " " 1,420° Brine
E " " 1,420° Brine
Time period 30 min except for steel A
Size of test blocks 2½" × 1¼" × 0.300"
Analyses
Note - A14 - Heated to 1650° quenched. Held 14 hours at 1410°.
A11 - Heated 1650° slowly. Cooled to 1410° Held at 1410° for 30 minutes
A13 - Held 30 minutes at 1680° Cooled over period of 7 hours to 1300° Held 30 minutes at 1460°
1 hour at 1440
3¼ hours at 1440
1¼ hours at 1480
Rockwell "C" Numbers
Drawing Temperature Deg. F, Time Period 30 Min. (Except as Noted)

FIG. 2

	C	Mn	Si	Cr	Wo	Vd	Co	S	P
Steel A	0.68	0.20	0.32	4.00	18.00	1.00	-	0.015	0.015
" B	0.90	0.20	0.25	0.80	-	0.20	-	0.015	0.015
" C	2.20	0.20	0.30	12.00	-	0.80	0.50	0.015	0.015
" D	0.80	0.20	0.25	-	-	-	-	0.015	0.015
" E	1.10	0.20	0.25	-	-	-	-	0.015	0.015

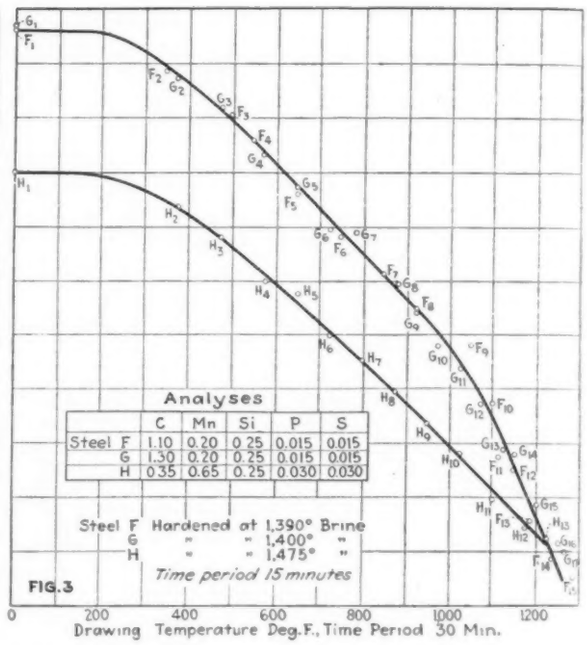
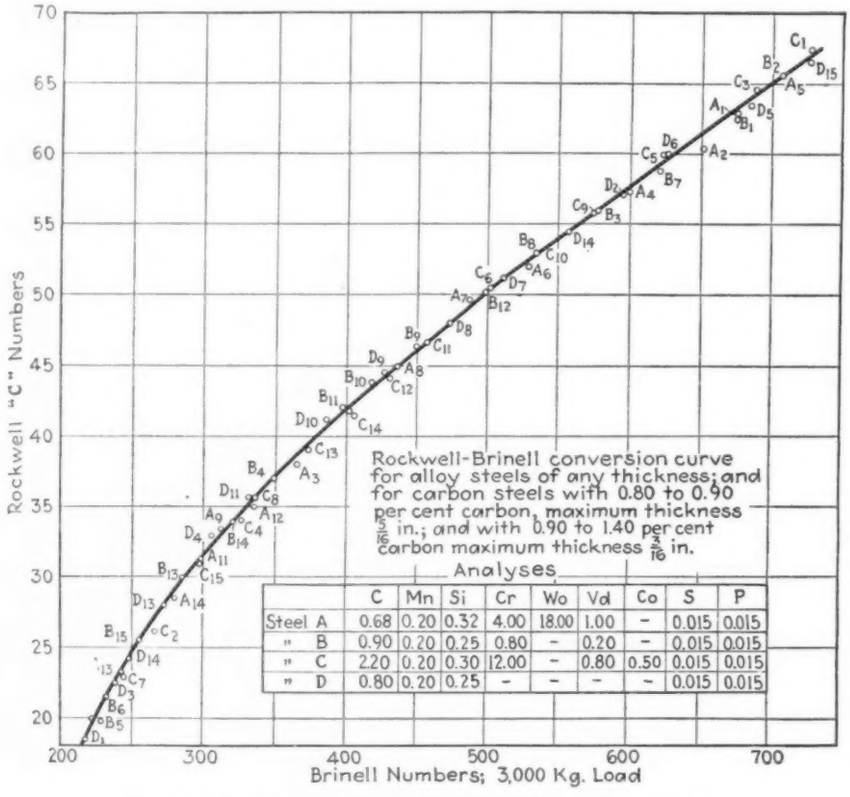


FIG. 3

	C	Mn	Si	P	S
Steel F	1.10	0.20	0.25	0.015	0.015
G	1.30	0.20	0.25	0.015	0.015
H	0.35	0.65	0.25	0.030	0.030

Fig. 2 — Results of hardness tests on samples of steels A, B, C, D, and E. Fig. 3 — Results of hardness tests on samples of steels F, G, and H

deg. F. Change of tempering temperature alone increased production from 20,000 pieces at 350 deg. F. to 75,000 pieces at 400 deg. F. This variation of 50 deg. in drawing temperature only lowered the Rockwell "C" hardness one and one-half numbers. Moreover, it was found necessary to watch both time and temperature of both hardening and tempering to duplicate the required hardness. An average of five Rockwell readings invariably came within one-half a number of Rockwell C-62.5. It is evident, therefore, that five numbers variation in Rockwell "C" hardness at C-60 is inadmissible in good die practice.


Rockwell-Brinell conversion curve for alloy steels of any thickness; and for carbon steels with 0.80 to 0.90 per cent carbon, maximum thickness 5/16 in.; and with 0.90 to 1.40 per cent carbon maximum thickness 3/16 in.
Analyses
Rockwell "C" Numbers
Brinell Numbers; 3,000 Kg. Load

	C	Mn	Si	Cr	Wo	Vd	Co	S	P
Steel A	0.68	0.20	0.32	4.00	18.00	1.00	-	0.015	0.015
" B	0.90	0.20	0.25	0.80	-	0.20	-	0.015	0.015
" C	2.20	0.20	0.30	12.00	-	0.80	0.50	0.015	0.015
" D	0.80	0.20	0.25	-	-	-	-	0.015	0.015

Fig. 4 — Showing that a single conversion chart or table can be prepared for deep-hardening steels

The question naturally arises whether conversion tables can be used at all when the results of careful and reliable investigators differ over such a wide range. Previous investigators have endeavored to develop one conversion table for all types of steel. It will be shown that this is impossible, and may partly account for the apparently contradictory results.

The Wilson-Maeulen Company, makers of the Rockwell hardness tester, had realized for some time the unreliability of the use of hardness conversion tables, and attempted some 18 months ago to develop one of their own. It was soon discovered that no one table could be used for conversion purposes, and that some of the existing tables were quite misleading. In order to explain satisfactorily certain features of the Wilson-Maeulen investigation, it became necessary for the writer to make a further investigation.

The steels used in determining conversion values included five analyses of carbon tool steel with carbon content ranging from 0.35 to 1.30 per cent, one light alloy of chrome-vanadium steel, and two heavy alloy steels with carbon in the case of steel C as high as 2.20 per cent. If analysis had any effect on conversion between the two systems, this wide variation in analysis should show it up.

Fifteen test pieces were made of each of steels *A, B,*

C, *D*, and *E* bars $\frac{3}{8}$x1$\frac{1}{2}$ in. in section, and of the shape and size of the Rockwell test blocks, namely 2$\frac{1}{2}$ x 1$\frac{1}{4}$ x about 0.300. in. The size of the test pieces for steel *F* was 1x1x1$\frac{1}{4}$ in.; those for steel *G*, 1x$\frac{3}{4}$x1$\frac{1}{4}$ in.; and those for steel *H*, $\frac{1}{2}$ in. thick x 1 in. diam. In machining these test pieces care was taken to remove all decarburized steel by removing $\frac{1}{32}$ in. from all surfaces. Samples were surface ground before hardening, with the exception of steel *A*, the high speed steel.

The proper heat-treatment of samples and subsequent grinding are exceedingly important steps in securing accurate results. Steel may be carburized or decarburized in hardening. In the case of high speed steel, soaking too long at the hardening heat, too high a hardening heat, or an uneven distribution of heat, may result in spotty and variable surface conditions due often in this case to the volatilization of the micro-constituents. In grinding, the temper of steel may be drawn slightly to a depth of a few thousandths of an inch, and in the case of some alloy steels the surface may be decidedly glazed. Many of the light alloy steels and all of the carbon steels are susceptible to having soft spots, or regions of tapering and uneven hardness, if improperly quenched.

Any one of these conditions will affect the hardness readings in varying ratios for the two systems of hardness measurement, and will cause an error to be introduced. Because of the importance of the proper preparation of samples, the methods pursued for obtaining uniformity of hardness distribution are described in detail.

Some samples were heated in an atmosphere of illuminating gas to prevent scaling, and then lightly cleaned with emery cloth. Others were heated in the ordinary way, and then very lightly cleaned up on the side of an Alundum wheel (grain 120). Both methods gave good results with greater uniformity possibly resulting from the use of illuminating gas. In the case of the 0.35 per cent carbon steel and high speed steel, illuminating gas could not be used as carbon absorption would have taken place.

All steels, with the exception of the high speed steel, were heated for hardening in an electric furnace of special design, a photograph of which is shown in Fig. 1. The temperature of the furnace was held within plus or minus 5 deg. F. of the desired temperature by the automatic heat control at the left-hand side of the control board. The thermocouple for this control is situated in the upper right-hand corner of the heating chamber which measures 8x11x16 in. The automatic control at the right is connected with a thermocouple situated in the middle of the bottom of the heating chamber and in contact with the sample being heated. As soon as a sample reached the uniform temperature of the furnace, the time was signalled by the right-hand control. In this way, time and temperature were controlled automatically.

A non-scaling chrome-steel muffle forms the heating chamber and is heated on all four sides by resistance wires. Illuminating gas can be caused to enter the furnace through the rear and leave through the peep hole shown in the front door, where it can be burned if desired.

Steels *B*, *C*, *D* and *E* were heated in illuminating gas and the hardening temperatures are shown on Fig. 2. As steels *B*, *C* and *E* are super-saturated with respect to carbon for the hardening temperatures used, there is no possibility of carbon absorption. Steel *D*, however, when hardened at 1,420 deg., theoretically may absorb carbon slightly. In practice no difference in surface hardness was noticed by hardening either with or without gas.

It was found that, when using gas, samples had to be removed immediately from the furnace on opening the door. A slight delay often produced a soft skin, probably caused by slight carbon deposits generating carbon

Table I—Results of Hardness Tests by Wilson-Maeulen Company

Sample Number	Rockwell "C" Reading	Brinell Reading	Sample Number	Rockwell "C" Reading	Brinell Reading	Sample Number	Rockwell "C" Reading	Brinell Reading	Sample Number	Rockwell "C" Reading	Brinell Reading	Sample Number	Rockwell "C" Reading	Brinell Reading
A_5	65.7	707-H 683	B_2	65.7	707-H 683	C_1	67.5	707-H 713	D_{15}	66.75	732-H 683	E_4	68	732-H 713
A_1	63	695-H 652	B_1	63	683-H 652	C_3	64.75	677-H 667	D_5	63.5	695-H 674	E_2	66.5	707-H 683
A_2	60	627	B_7	58.7	617	C_5	60	622	D_6	60	624	E_7	62	640-H 637
A_4	57	600	B_3	56	578	C_9	55.8	578	D_2	57.25	592	E_3	58	583
A_6	52	512	B_8	53	532	C_{10}	53	532	D_{12}	54.5	560	E_8	53.25	518
A_7	49	495	B_{12}	50.2	495	C_6	50.5	500	D_7	51.25	509	E_9	51	491
A_8	45	430	B_9	46.3	444	C_{11}	46.75	460	D_8	48	471	E_{12}	47	434
A_{10}	41.8	402	B_{10}	43.8	418	C_{12}	44.25	430	D_9	44.5	430	E_{13}	43	398
A_3	38	364	B_{11}	42	396	C_{14}	41.5	410	D_{10}	41.25	385	E_{14}	39	338
A_{12}	35	332	B_4	37	345	C_{13}	39	371	D_{11}	35.75	330	E_5	34	307
A_9	33.5	311	B_{14}	34	317	C_8	35.75	330	D_4	33	302	E_1	31.5	288
A_{11}	31.3	293	B_{13}	30	280	C_4	34	321	D_{13}	28	269	E_{15}	28.5	273
A_{14}	28.5	277	B_{15}	25.5	251	C_{15}	31	293	D_{14}	24.25	246	E_{10}	25.75	252
A_{13}	22.5	255	B_6	21.5	228	C_2	26.25	262	D_3	22.5	235	E_{11}	23.75	237
			B_5	20	219	C_7	23	241	D_1	18.5	214	E_6	19	218

After regrinding, readings were obtained as follows:

Sample Number	Rockwell "C" Reading	Brinell Reading
A_1	63.3	677
A_2	60.4	658
A_4	57.4	600
A_7	49.7	488
A_{13}	23.3	243

Check tests on E_4 gave a Rockwell reading of 67.3, and a Brinell reading of 728-H. In all cases above, H denotes the use of a Hultgren ball.

dioxide which acts as a strong decarburizer of steel. For quenching purposes, some samples were drilled and tapped and screws inserted; 0.300x1¼x2½ in. samples of steels *B*, *D* and *E* were notched at the corners and a heavy wire passed around them; while some were held with tongs. The most reliable method proved to be drilling and tapping. When tongs are used they must be dry, and of such a shape as not to cause eddy currents where they touch the steel. In the latter case tapering and uneven hardness will result. Any method which ensures positive and quick circulation of the water or brine in contact with the testing faces results in uniform hardness. Steels *E*, *F*, and *G* are especially susceptible to soft spots in quenching, and the above precautions must be rigidly followed.

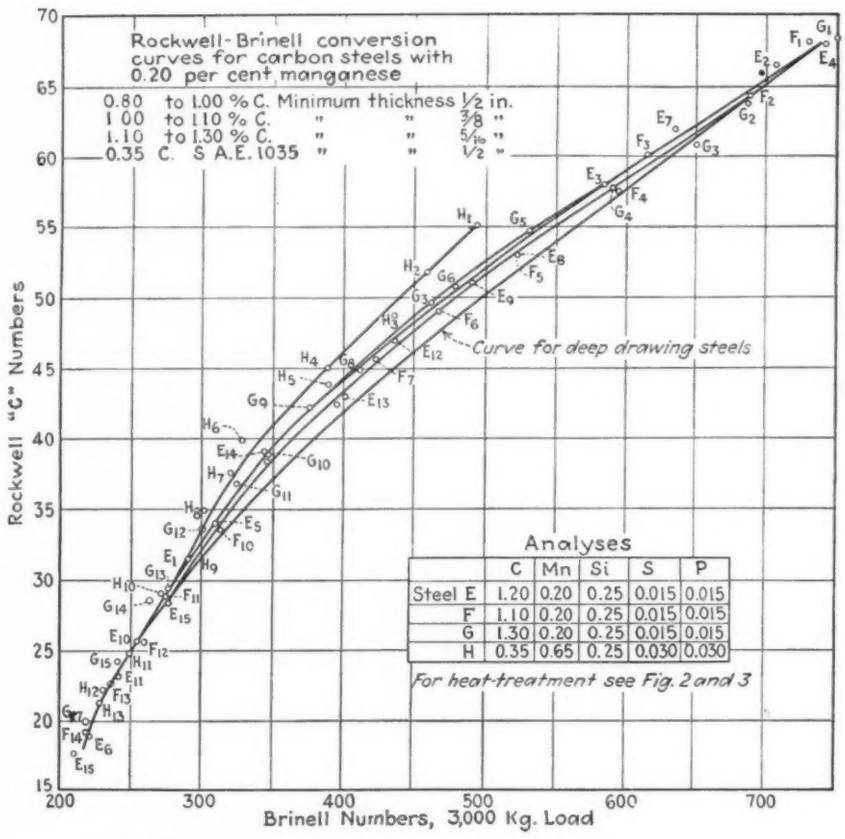

Rockwell-Brinell conversion curves for carbon steels with 0.20 per cent manganese
0.80 to 1.00 % C. Minimum thickness ½ in.
1.00 to 1.10 % C. " " ⅜ "
1.10 to 1.30 % C. " " 5/16 "
0.35 C. S.A.E. 1035 " " ½ "
Curve for deep drawing steels
Analyses
C Mn Si S P
Steel E 1.20 0.20 0.25 0.015 0.015
F 1.10 0.20 0.25 0.015 0.015
G 1.30 0.20 0.25 0.015 0.015
H 0.35 0.65 0.25 0.030 0.030
For heat-treatment see Fig. 2 and 3
Rockwell "C" Numbers
Brinell Numbers, 3,000 Kg. Load

Fig. 5 — Showing that a single conversion chart cannot be prepared for steels that are not deep-hardening

Brine was found to be superior to water in preventing soft spots. Apparently the air dissolved in water has a tendency to adhere to a surface in the form of bubbles causing soft spots or areas. A 36-per cent solution of table salt and water contains no air and soft spots from this cause are avoided. However, large surfaces, say 2 in. square and over, are liable to have soft spots even with a brine quench. In this case "steam blankets" are the cause, and soft spots can be avoided only by a stream of water directed against the face of the piece being hardened, and flowing up from the bottom of the tank while the piece is held face down under the surface of the water and against the stream. Steel *C* is of the high-carbon, high-chrome type, and not in the least susceptible to soft spots in quenching. It can be uniformly hardened by dropping into a wire basket placed in a tank of warm oil, moving the basket up and down to prevent excessive carbon deposits due to decomposition of the quenching oil. *A*, a high speed steel, received the usual double heating, preheating to 1,600, and a final heat of 2,300 deg. F. A higher heat caused a marked increase in surface volatilization, and was not considered. Samples were soaked for 15 sec. at 2,300 deg. F. to insure uniformity of heat distribution. Gas-fired furnaces were used for hardening steel *A*. Both the *C* and the *A* series of test blocks were heated by placing them on nickel trays. Oil quenching was used in both cases.

The *A* series of blocks had to be ground after hardening, but it was thought well to do this before tempering so as to neutralize as much as possible any uneven surface conditions caused in grinding.

Samples were tested in five different places for uni-

Table II—Results of Hardness Tests by Another Laboratory

Sample Number	Rockwell "C" Reading	Brinell Reading	Sample Number	Rockwell "C" Reading	Brinell Reading	Sample Number	Rockwell "C" Reading	Brinell Reading	Sample Number	Rockwell "C" Reading	Brinell Reading	Sample Number	Rockwell "C" Reading	Brinell Reading
A_5	66.2	709	B_2	66.1	709	C_1	68.0	748	D_{15}	67.5	724	E_4	68.4	755
A_1	63.3	698	B_1	63.4	671	C_3	65.2	703	D_5	64.5	678	E_2	67.1	686
A_2	60.7	662	B_7	59.3	627	C_5	60.9	628	D_6	60.8	627	E_7	62.7	631
A_4	57.3	611	B_3	56.6	578	C_9	56.3	574	D_2	58.1	599	E_3	58.6	587
A_6	53.0	547	B_8	53.6	538	C_{10}	54.3	538	D_{12}	55.3	557	E_8	54.3	529
A_7	49.9	500	B_{12}	51.0	502	C_6	51.9	506	D_7	52.3	514	E_9	51.9	491
A_8	45.5	444	B_9	47.1	456	C_{11}	48.1	456	D_8	49.3	476	E_{12}	47.7	439
A_{10}	42.7	403	B_{10}	44.6	420	C_{12}	45.4	433	D_9	45.3	427	E_{13}	44.2	403
A_3	39.0	368	B_{11}	42.9	401	C_{14}	42.8	401	D_{10}	42.2	389	E_{14}	40.5	352
A_{12}	35.7	340	B_4	38.2	354	C_{13}	40.7	377	D_{11}	36.7	333	E_5	34.7	313
A_9	33.8	313	B_{14}	34.7	325	C_8	36.8	342	D_4	33.9	310	E_5	32.5	295
A_{11}	32.0	304	B_{13}	31.0	290	C_4	35.1	330	D_{13}	29.3	277	E_{15}	29.4	279
A_{14}	29.4	284	B_{15}	26.2	259	C_{15}	32.1	301	D_{14}	25.0	250	E_{10}	26.5	259
A_{13}	23.7	256	B_6	22.3	236	C_2	26.9	269	D_3	23.4	240	E_{11}	23.8	246
....	....	...	B_5	20.4	224	C_7	24.1	247	D_1	19.1	221	E_6	19.9	224

formity of hardening before being tempered. With proper precautions in testing, all samples showed an average hardness which came to within one-half a Rockwell division of the hardness of the "no draw" samples shown in Figs. 2 and 3. Any one of five readings on the same test block came within about one-half a Rockwell number of the average of these readings.

The time of soaking at the hardening heat was 30 min. for steels *B, C, D* and *E*, whereas for those heated without gas 10 min. was used. Tempering up to and including 750 deg. F. was done in a salt bath equipped with a mercury thermometer, whereas for temperatures in excess of 750 deg. F. the electric furnace was again used. For steels *A, B, C, D* and *E*, where it was desired to keep the samples absolutely clean during tempering, both the tempering and the cooling after tempering were done in an atmosphere of gas for temperatures above 850 deg. F. Scaling was thus prevented.

Steel *C*, when drawn for 30 min. at 1,440 deg. F., gave a Rockwell hardness of C-29. This steel begins to harden at 1,450 deg. F., and so the only thing left to do was to increase the period of soaking at 1,440 deg. to get a Rockwell reading under C-29. Hence the necessity of soaking for 3¼ hours at 1,440 deg. F. to produce C-22.5 in the case of sample C_7.

Similarly, high-speed steel begins to harden at 1,490 deg. F. But increasing the time period at 1,475 deg. F. to 14 hours only gave a reading of C-34. In this case, the treatments shown in Fig. 2 resulted in producing the required hardness numbers. All high-speed steel samples heated in illuminating gas were copper plated to prevent carbon absorption when subjected to heats above 1,400 degrees.

Test blocks made of steels *A, B, C, D* and *E* were subjected to three Rockwell and two Brinell checks. We checked them after hardening for Rockwell hardness, and then Wilson-Maeulen Company, and another testing laboratory, checked them for both Rockwell and Brinell hardness. As our readings at the time were only made to check heat-treatment, the time of application of the load being more or less disregarded, the figures of Wilson-Maeulen Company, and those of the laboratory mentioned, are the only ones given. However, in the case of steels *F, G* and *H*, the necessary precautions were taken, and our readings come within a fraction of a Rockwell degree of those of the Wilson-Maeulen Company.

Comparison of Tables

Tables I and II show the hardness values as obtained by Wilson-Maeulen, and the laboratory mentioned, on steels *A, B, C, D* and *E*. The hardness values of these tables were plotted into curves and, in Figs. 4 and 5, are thus shown.

In plotting steels *A, B, C, D* and *E* the Rockwell readings of the Wilson-Maeulen Company were used, and the average of the Brinell readings of the company and those of the laboratory mentioned. In plotting steels *F, G* and *H*, our readings were used throughout.

It will be noticed, in Table I, that the use of a cold-worked Hultgren ball results, in the case of steels of a hardness of C-62 or over, in an appreciable increase in Brinell hardness, showing that ordinary balls flatten more than the Hultgren ball on extremely hard steel. In order to avoid as much as possible an error due to the flattening of the Brinell ball, a new ball was used on each test block. Standard Rockwell machines were used throughout, and Alpha Hydraulic Brinell testers without packing. All machines were calibrated very carefully.

Reference to Fig. 4 shows that the readings from steels *A, B, C*, and *D* plot into a single curve, and that the average hardness of any of the sixty samples is within about one-half a Rockwell number of the hardness-conversion curve. Samples A_1, A_4, A_7, and A_{13} were low in Rockwell hardness, as shown in Table I. However, grinding of $\frac{1}{32}$ in. corrected these errors, and in plotting Fig. 4, the corrected values were used.

Steels *A, B* and *C* are alloy steels, and harden clear through with a uniform hardness on a section 1½x2½x 0.300 in. Steel *D* is an 0.80-per cent carbon steel containing no alloying metal, but nevertheless on this section shows a uniform hardness throughout.

Analysis has no effect, apparently, on Rockwell-Brinell conversion, for the steels shown in Fig. 4 differ widely in analysis. However, they harden uniformly throughout their section, and it will be shown, in the next part of the article, that this is the determining factor for correct Rockwell-Brinell conversion, and that the results on the steels of Fig. 5 do not plot on the same curve as the results on the steels of Fig. 4 because the former steels are not "deep hardening."

SEEN · AND · HEARD

By John R. Godfrey

Replacing the diamond— Press fits

THE new tungsten-carbide alloys are finding fields outside of what we usually consider as cutting tools. In addition to the regular lathe, or similar tool, the new alloys are replacing the diamond to some extent in finishing cuts in bronze and other bearings. In some cases, also, the new alloys are being used as dies for drawing fine wires, a field in which the diamond has had almost a monopoly for many years. In fact, this was the first use of the metal. The results in both cases, seem likely to open fields of usefulness that have never before been open to metals of any kind.

* * * *

Standard practice in making press fits is to increase the difference in diameter between the hole and the shaft with the increase in size of the parts. A common method is to allow a thousandth of an inch per inch of diameter, although the increment frequently decreases somewhat for large diameters. Both the length of the fit and the amount of metal around the hole affect the pressure required for the same allowance, and by the same token make it possible to decrease the allowance and yet secure as good a fit.

A reversal of the usual practice, however, is found in the case of one shop where cast-iron bushings are forced into long cylinders. Here, not only does the rate of allowance per inch of diameter decrease, but the *total* allowance is less in the larger sizes. A 25-in. bushing, for example, has only a total allowance of 5-thousandths while a 30-in. bushing has no allowance whatever. While this may, and evidently does, work out well in bushings, it is doubtful if it would hold in the case of shafts forced into flywheels, or where power must be transmitted by the parts.

Handicapping Salesmen With Wrong Information

THERE was a confab under way in the office of the National Electric Company. Amos Bolton, the general manager, was holding a sort of inquest over some kick he'd had from Frank Cousins, one of his best salesmen. Both the salesmanager, Hawkins, and the chief engineer, Blackman, were also in the office, in addition to Bill Holland, who had been invited to sit in and add his experience.

"What I'm kicking about," said Cousins, "is that the office doesn't give me enough information about the motors I'm trying to sell, and when they do send me a lot of dope, it's usually wrong."

"Can you back that up, Frank, or is it just letting off steam?" asked Bolton.

"You bet I can, Mr. Bolton. Take that case of the Spencer Manufacturing Company only last week. I sold them a good sized National motor to go on a new machine they are building. They asked for the general dimensions, especially the bolt holes for the feet. So I left them the small blueprint Mr. Hawkins gave me to go by. Then, to make sure, I wired Hawkins to find if there had been any changes. He wired me the print was practically O. K., but that, to be dead sure, he would mail a new blueprint right from the engineering department."

"That sounds like co-operation, Frank, you can't kick about that," broke in Bolton.

"That's what I thought, Mr. Bolton. I sort of patted myself on the back for being hooked up with such a live outfit, until I got a wire from Spencer to come over at once."

"And then what happened."

"Fireworks, Mr. Bolton. They were sore as a pup—and I don't blame them a bit. For when the motor arrived it wouldn't go on the bracket at all. The size was wrong, the bolt holes didn't match and it was a mess in every way. Either Hawkins sent the wrong blueprint, or the engineering department had changed sizes, but gave him an old print to send out. Spencer had to throw the bracket away and make a new one, and that meant a delay in their shipment of the machine. And before I sell him another motor I've got to prove that we are real manufacturers and not a bunch of experimenters who never make two motors alike."

"Sounds pretty bad, Frank," mused Bolton. "Ever hear anything like that in your travels, Holland?"

"Yes, Bolton, I have," replied Bill, "although that is about as aggravating a case as I know about. I know of one motor builder who sent three motors to go on new machines for his own use, and they were all different although the machines were identical. The machine builder had to change the brackets on two of them.

"Then, too, there are machine builders who leave a lot of guess work for the buyer when it comes to motors. If Frank's case is typical, perhaps they can't get accurate information to pass along."

"Doesn't seem to be much need for such a condition," said Bolton, turning to Hawkins and Blackman. "If you two men will get together on this you ought to be able to prevent such a case happening again. It ought not to be difficult to notify Hawkins of every change that goes through, providing it affects the sale, as the size and location of holding bolts certainly does."

"Incidentally," said Holland, "that's one of the points that users of motors have been trying to get standardized for years. So far they haven't been very successful because the motor builders balk. But it's my guess that unless they agree to some standard pretty soon, the large users will get together and tell the motor builders what the bolt sizes and bolt centers must be on the motors they buy. Then Frank Cousins won't have the troubles he mentions."

"Any standardization movement of that kind can bank on us to back it up, Holland," said Bolton.

EXECUTIVE FORUM

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

Discussion

Should a Buyer Specify Design or Results?

Most up-to-date shop men are beginning to look at production as the main point to consider, especially when the machine builder is known to be thoroughly reliable. Primarily, they are interested in results and not in the design of the machine.

Guaranteeing that the machine is good and adequate for the work to be performed, will not help the situation when the operators, who are on piecework, cannot be depended on to oil the machines. When machines go wrong due to improper lubrication, production is held up—a costly matter. There is involved not only the direct loss of service but also the cost of repairs and the delay and confusion all along the line. Therefore the buyer is justified in requesting that the machine be equipped with a lubricating system that gets lubricant to every bearing. Lubricating the machines will not then depend upon the workers and the inevitable tie-up in production existing when piece-rate operators are charged with this responsibility, will be avoided.

—Louis Shaffer.

When the Rush Comes

Very often the production man is called upon to solve an almost unsolvable problem. I remember a case in my own factory: Our manager had promised the delivery of a large number of locomotive feed pumps in a very short time, and the delivery period was under penalty. Forgetting existing methods, the calculation engineer, and I, as production engineer, laid out a new operation plan for the pump. Almost every part was to be machined in jigs and fixtures. Very often we were forced to change the design to shorten the machining time. In this way, after a week of hard work, we finished the job.

We found that one must not think that a fixture is good just because it is a fixture. We found that between one fixture and another fixture, one could waste or save a great number of minutes. Further, we designed special tools and multiple cutters, and again we could save precious minutes. We demanded a change in the construction of nearly 50 parts, in order to make the most simple fixtures for them, or so that we could machine them easier.

We made a new machine layout in our workshop in order to secure the shortest material movement possible. Our manager bought two or three special machine tools. Finally, I think it almost unnecessary to say, we used tolerance gages, so that new men could do good work after some teaching.

It was hard work, but it was a fine training and we made our time. But the best of it was the knowledge that an engineer has many ways to make possible the apparent impossibility.

—Franz Bermann, *Austria.*

Preventing Unfair Rejections

The manufacturer who accepts an order with tolerances that are unnecessary and banks on their being overlooked, is taking a chance. The buyer may have specified a certain dimension so as to have a tolerance to shoot at, or he may have included that dimension just to have a loop hole to reject the manufactured article when he did not need any more. On the other hand, the complaint made by the buyer that the gears he purchased were noisy is rather an easy alibi to bring forth. The true state of affairs was that he was stocked up.

Of course, it is rather difficult to write specifications that neither side can crawl out of. But the noise clause is loophole enough for anyone until the manufacturer can get a standard to go by.

As a protection for the contractor, I believe that contract standards should be set up for such cases, and that impartial engineers should look over the rejections and decide whether they are right or wrong. —Harry Kaufman.

The Man Over Fifty

The idea that a man, of necessity, attains his peak of usefulness below 50 was more deeply rooted a generation ago than it is today. It still persists in many quarters, however, like many another outworn theory.

As far as workmen are concerned, it is probably true that they lose something in speed, momentarily considered. But such speed is at best only part of the story. It is in dependability and application that the conscientious elderly worker shows to advantage. He may not be able to spurt with the vim of youth; but he lasts, and over a period his quantitative results will, as a general rule, compare favorably with those of his younger colleagues.

The man of 50, too, is a proven man and makes an able foreman. His ripe experience in the craft, and in his knowledge of his fellowmen, is an asset.

—W. R. Needham, *England.*

Airplane Welding Fixtures

Photographs by courtesy of Command-Aire, Incorporated

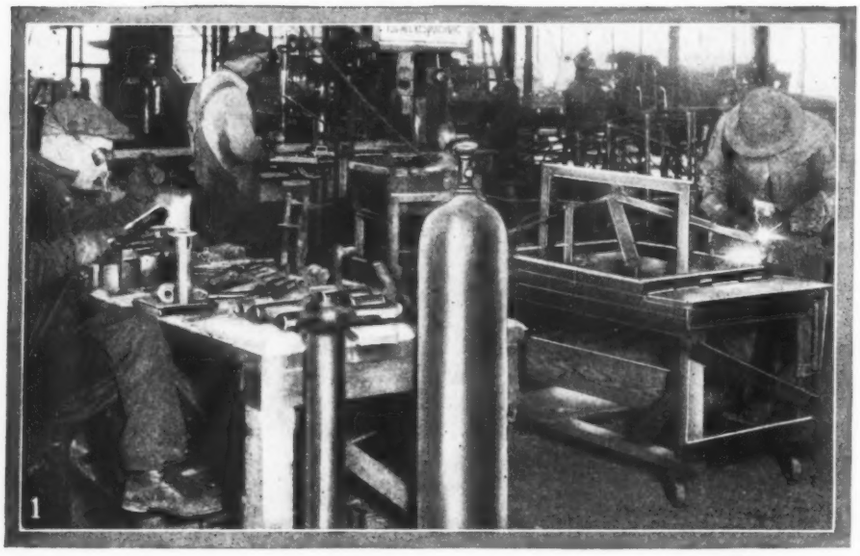


Fig. 1—A corner of the welding shop where landing gear axle ends and other parts are built up by oxy-acetylene welding. A small welding fixture is shown on the movable truck at the right

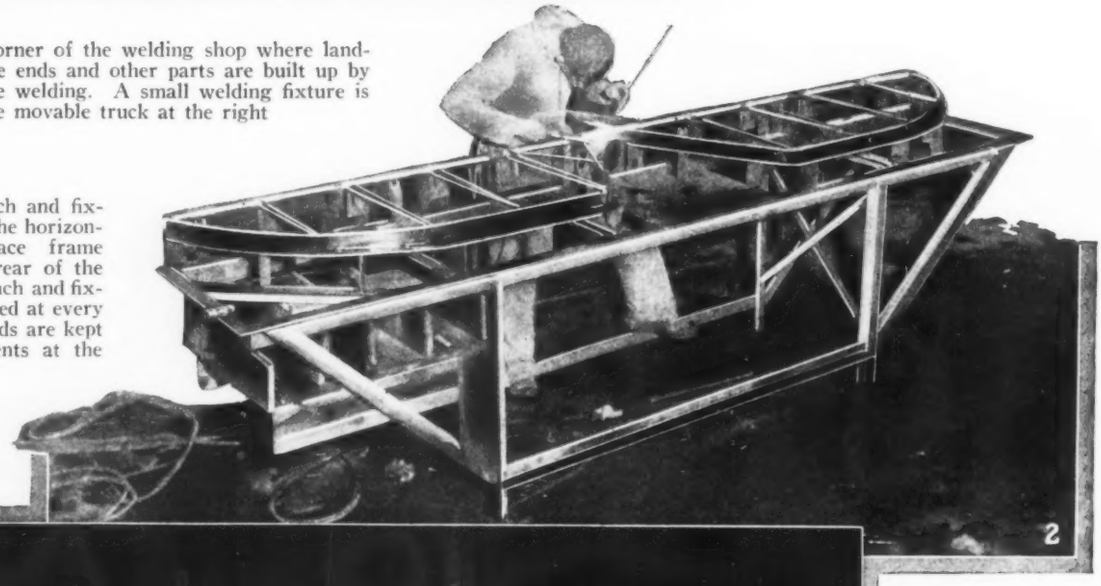


Fig. 2—Steel bench and fixture for welding the horizontal control surface frame that goes at the rear of the fuselage. The bench and fixture are both welded at every joint. Welding rods are kept in the compartments at the left

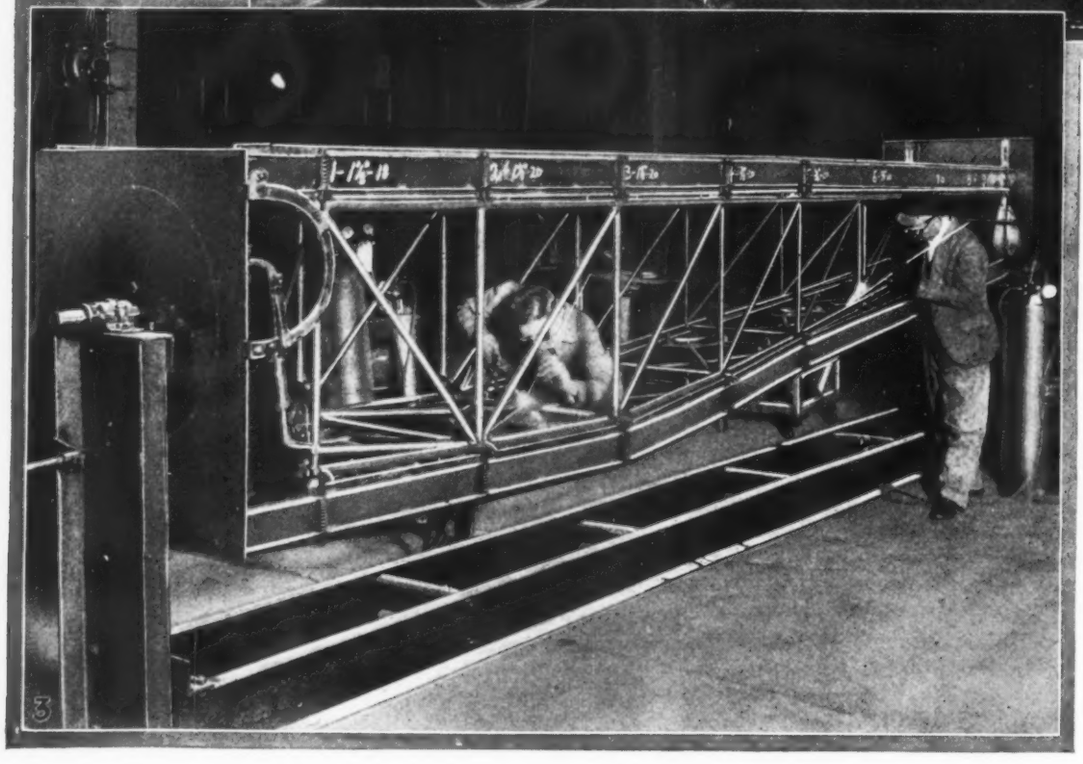


Fig. 3—Fixture in which fuselage is welded. Spring clamps hold the chrome - molybdenum tubing in place while the indexing feature of the fixture allows it to be turned to any desired position

Periodic Inspection of Cylinder Blocks

By Fred H. Colvin
Editor, American Machinist

A method by which many between-operation inspections are eliminated, the accuracy of fixture and tools being checked by periodical inspections of the part

INSPECTION at the plant of the Reo Motor Car Company is very thorough. But the methods vary from those found in many other plants in several ways. Taking the cylinder block as an example, a noticeable difference is the absence of frequent inspection of the blocks in process such as is found in some other plants. The theory which seems to be growing in favor is that with modern fixtures, well maintained in the toolroom, the product must be within very close limits at all times. Furthermore, any variation beyond the tolerances permitted will be caught at the next operation.

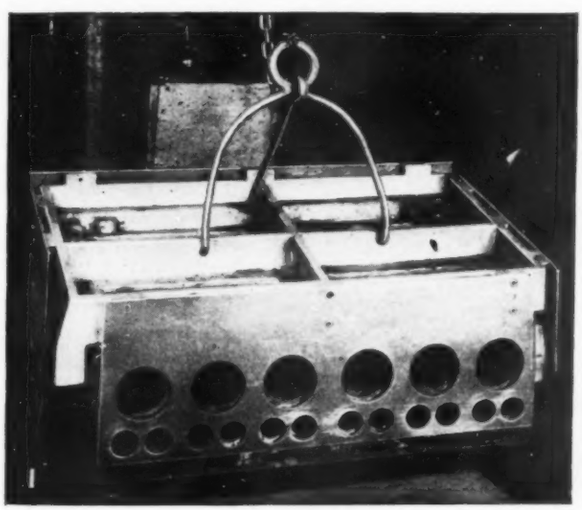
This does not mean, however, that no inspection is made until the block is completed. It simply means that not every block is inspected between each operation, as is advocated by some.

The first inspection is made of the rough casting in the box testing fixture, or gage, Fig. 1. With the cylinder block lying on its side on a bench and the test fixture suspended on a small hoist, the fixture is lowered over the casting. Visual inspection shows the amount of metal for machining at all important points. The top plate, for example, shows the alignment of the cores for the six cylinder bores and for the twelve valve seats. The bottom and end plates act as target gages and show the inspector whether or not the various bosses and openings are in their proper positions.

Each machining fixture is designed as far as possible to act as a check on the preceding operation, and it is not found necessary to have a corps of floor inspectors check each operation. Instead of this a completely finished cylinder block is sent to the main inspection room at stated periods, frequently but once a day, where it is checked completely by gages kept for the purpose. With the cylinder block on a large surface plate, every machined surface is checked carefully. The bores, for example, are inspected with the type of gage shown in Fig. 2, diameter, roundness, and parallelism being carefully noted.

Other inspections are illustrated in Fig. 3 where the cylinder block is supported on small jack-screws and is leveled carefully on the surface plate. In this position the height of the upper surface from the plate and the relative location of the crankshaft and camshaft bores are being checked. The squareness of the ends is also checked with suitable gages and measuring instruments. These thorough inspections catch any variations from standard, and indicate which machining fixtures, or tools, need attention. Care in the toolroom in inspecting and reconditioning fixtures and tools at frequent intervals, secures a remarkably uniform product and makes the inter-operation inspection seem unnecessary, judging by the results secured over a long period.

When each cylinder block reaches the end of the machining line, however, it is given a 100 per cent in-



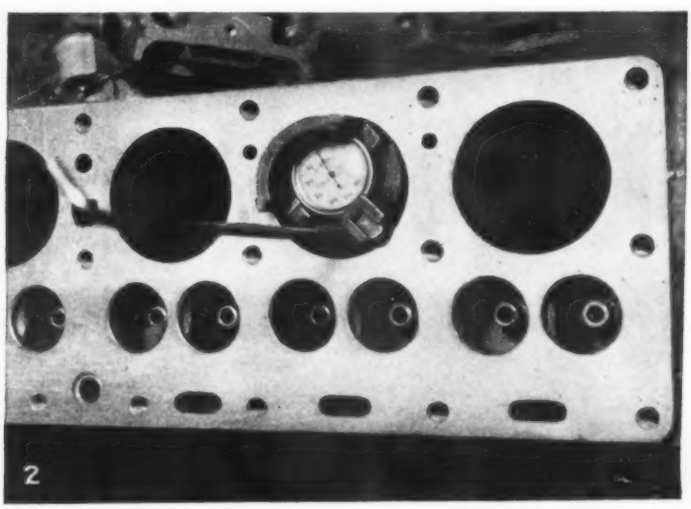


Fig. 1—Box jig for checking the rough cylinder block casting. Cored holes, bosses and other surfaces show in this jig whether or not they will clean up in machining. Fig. 2—Gaging the bores of a cylinder block in the inspection room where a block is carefully checked at stated intervals for all important dimensions

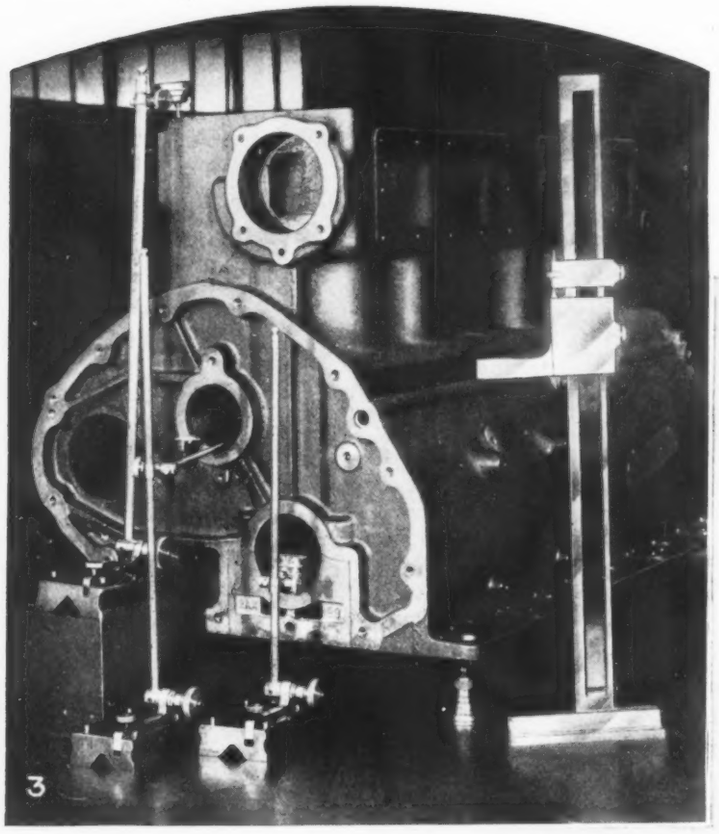


Fig. 3 — Checking crank and camshaft bores on a large surface plate. All other important points are also inspected at the same time

Fig. 4 — Bath inside micrometer or plug gage for cylinder bores. The gage is marked with letters instead of figures, and designates the bores in sizes from A to G

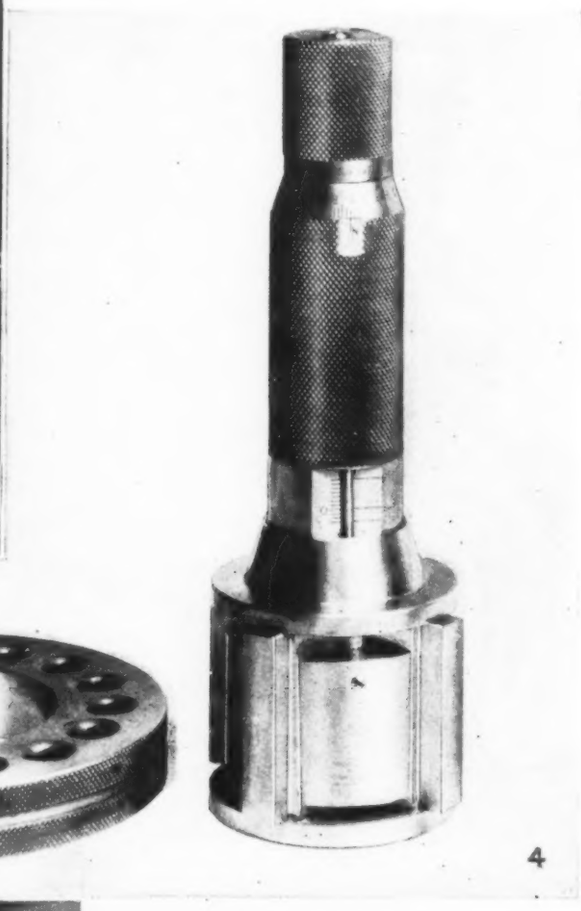


Fig. 6 — Checking the squareness of the piston pin hole with the sides of the skirt. The gage contacts with the skirt on each side of the pin hole

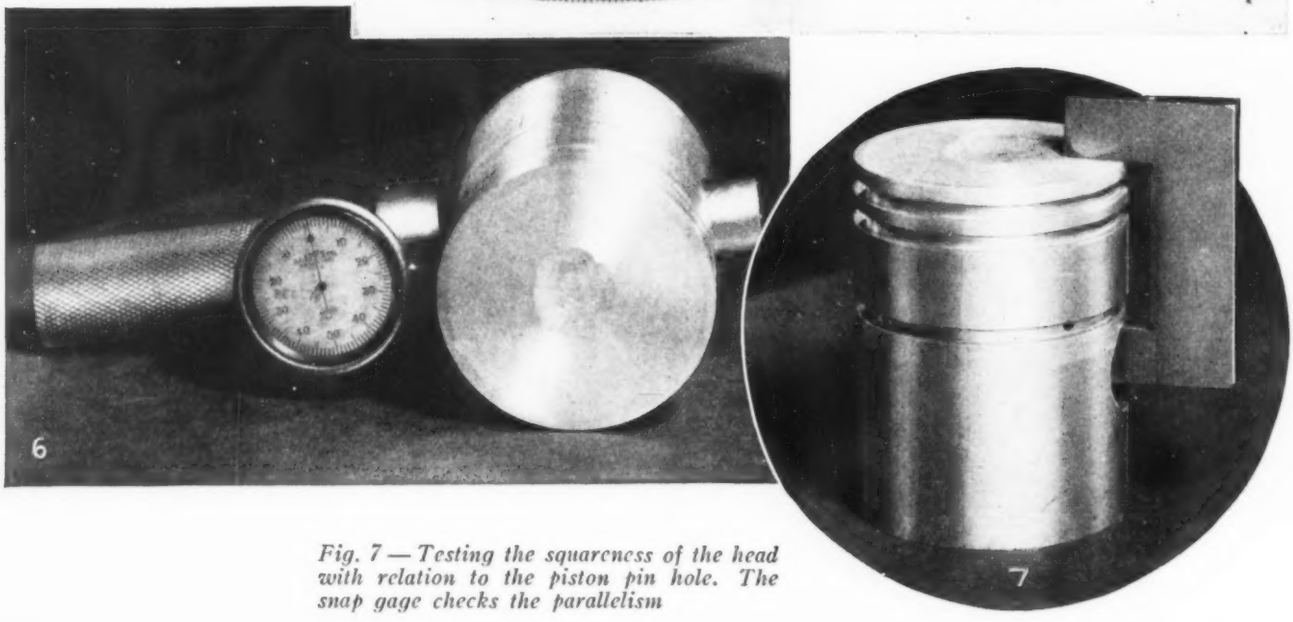


Fig. 7 — Testing the squareness of the head with relation to the piston pin hole. The snap gage checks the parallelism

spection to insure that no operations have been omitted. Oil lines are checked for clearness, and tightness, and sizes of tapped and reamed holes, are carefully inspected. Each cylinder bore is gaged carefully to determine which size of piston should be used to secure the proper clearance for satisfactory operation. Each bore is measured with a Bath inside micrometer, which, together with a standard ring, is shown in Fig. 4, the nominal size being $3\frac{3}{8}$ in. The sizes are not marked in inches, however, but are designated by letters as can be seen on the beveled surface of the sleeve on the micrometer. These letters show the sizes and the bores are classified in this way.

A large blackboard beside the gaging bench is used to note the sizes of the various bores, as in Fig. 5. Of the blocks shown, the first has all bores alike, of the *A* size. In the next block the first cylinder is a *C* size, the next two are size *B*, and the remaining three are like the first. The bores of the third block are again all alike, but of *E* size, while the fourth block varies between *F* and *E*. This blackboard is in plain sight of the man who selects the pistons from the racks where they have been sorted into the six sizes to maintain the desired clearances. As soon as the sizes are put on the board the piston man selects the pistons for that block, and has them ready when the block arrives at the proper point.

Piston diameters are measured with gages that are also marked with letters, the racks being designated in a similar manner, so that it is easy to pick the corresponding piston for each bore. A check on the correct piston diameter is made at an inspection station on the assembly line to insure that the correct letter sizes are fitted together. In finishing cylinder bores the inspectors insist upon holding the bores in any one block within two letters. The dimensions used for the cylinder bores, pistons and clearances are given in the accompanying table. Two other piston gaging operations are shown in Figs. 6 and 7. The first is checking the squareness of the piston pin hole with the outside of the skirt. A ground plug fits into the piston hole, and a feeler on the dial gage contacts with the piston skirt, the whole gage being turned through a half circle, to bring the feeler to both sides of the pin hole.

The second gage, Fig. 7, checks the length between the hole and the head, and also shows whether the two are parallel. This is a simple, solid snap gage, with go and no-go steps on the lower leg. It will be seen that no essential inspection is overlooked, even though the accuracy of the fixtures is entirely depended upon to secure the desired size and location of holes and surfaces on the cylinder block as a whole.

Piston Fitting Sizes for Cylinder Blocks

		A	B	C	D	E	F	G
Cylinder bore size	High	3.3742	3.3746	3.3750	3.3754	3.3758	3.3762	3.3766
	Low	3.3738	3.3742	3.3746	3.3750	3.3754	3.3758	3.3762
Piston size	High	3.3673	3.3677	3.3681	3.3685	3.3689	3.3693	3.3697
	Low	3.3669	3.3673	3.3677	3.3681	3.3685	3.3689	3.3693
Piston clearance	High	0.0073	0.0073	0.0073	0.0073	0.0073	0.0073	0.0073
	Low	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065

Figures allow 0.004 in. between letter sizes. Piston clearance, 0.0065 to 0.0073 in. Letter "E" is taken as standard.

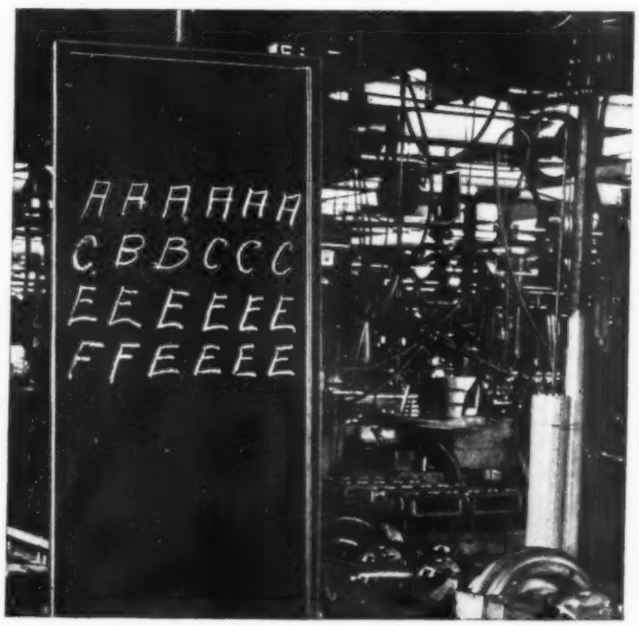


Fig. 5 — Blackboard beside the measuring bench where cylinder bores are gaged and marked. The board tells what pistons to have ready when the block arrives

Conversion Tables for Brinell and Rockwell Hardness Numbers

Many an annoying situation has arisen because of the difficulty of converting Brinell to Rockwell hardness numbers, and vice versa. The whole thing has finally been placed on a sound basis through a series of tests made by Alfred Heller and checked by other authorities. In the series of articles beginning in this issue, and continuing through the next two issues, the whole account of the method of hardening the specimens and making the tests is described. Aside from its practical value to the engineer the series is a liberal education in accurate hardening practice.

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Going Over the Super's Head

"MY OLD friend Black is having a heck of a time over at the Plow company, Al. You know they have an old fogy for a super, while Black is plumb full of new ideas."

"What's his particular trouble now, Ed?"

"The super has made him take, as assistant, one of his own pets who isn't at all progressive, and who is mighty little help. Black had a man all picked, who would have been a whiz, but the super says he must take this bird or nothing."

"And what does Black do, Ed? As I remember it, he's apt to do something, whether it's right or wrong."

"Well, after waiting to get his 'mad' over, he goes to the big gun, the general super, and tells him his tale of woe. He knows it's dangerous, but he takes a chance. And because Black has been such a darn good man, the general super backs him up, has the super in on the carpet and all the rest. But the super's man is still on the job."

"Then I can see where your friend Black has let himself in for an uncomfortable time as long as he stays there—or as long as the super does. It's a dangerous thing going over the super's head."

"But I thought you'd say he was right, Al. He felt he owed it to the firm, as he can't do good work with such an assistant."

"Of course he was right—in theory. It ought to be done as there's no other way of putting the general super wise to things in the shop. But the man who does it is laying up a lot of trouble for himself, just the same. I admire his nerve, but as long as the super stays around, his job isn't going to be any bed of roses."

"But shouldn't the general super protect him? He knows what Black has done for the concern, knows where he's saved them a bunch of money. Why can't he protect him now?"

"The general super has to consider whether the old super or Black is of most value. Black is young and progressive, and yet the old super has a store of experience that is of value. Then, too, it's not an easy task to let an old man out after he's done a lot of good work for the firm. If he fires the super's man, he advertises that Black has more power than the super. If he doesn't, Black is up against it. Either way he hasn't an easy choice, Ed."

"Then you don't think Black should have gone over the super's head, Al?"

"I'm not saying that he shouldn't, Ed. But before I went over Williams' head I'd try to get a line on a nice job somewhere else in case I needed it. In fact I think I'd go, without waiting to get fired."

Was Black right in going over the super's head? Or should he have sat tight and proved the new man was N.G.? Do you agree that Black should have looked for another job?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Whistling in the Shop

A HABITUAL whistler is not a thinker, his mind is not on his work or on responsibility in any form. There are forms of employment where a man can whistle "his head off" without any harm other than annoyance to those around him. If a man overdoes it, and it annoys, he should be notified in a gentlemanly manner, which will usually be sufficient. The idea of posting notices to that effect is uncalled for, and is not good practice. —SIGURD C. NIELSEN.

Helping the Tool Designer

ALMOST the first lesson impressed upon me in tool designing was this very point of "selling" the design to the foreman. It seems a natural channel for the foreman's thoughts to take, to visualize the sort of jig he would need for a job and the machine he would use. Consequently, he usually knows just the features which should be embodied in the new tool to realize the greatest production from a given machine.

It seems to me that it is these little details of design which make or mar the success of a jig or fixture, and no one is better qualified to present them to the designer than the foreman. —FRANCIS DICKSON.

Gang Bonus in the Shop

THE principle of group bonus requires that a man's individuality be lost to a large extent, as no record is made to show his particular accomplishment. The plan does not work a hardship on anyone if the men are properly selected, and there are not too many in a group.

The plan works out well in progressive assembly and similar work. Where I am employed, each man has an hourly rate, according to the skill required, and he also receives a bonus on the completed machines or units passed by inspections. Another place where this plan works well is in the loading and unloading of kilns in grinding wheel plants. Here, both the time taken and the percentage of good wheels enter into the figuring of the bonus. —L. F. SWANSON.

The Foremen's Ideas on Pensions

THE rapid spread of pension schemes is sufficient proof, if any is required, of their popular appeal. Far from resenting such provision the man in the shop welcomes it as a sign that his interests are not forgotten even when his usefulness is past. It is no exaggeration to say that old age is a nightmare to many, who, through no personal fault, have been unable to provide for it. Whether such pension schemes should be contributory depends largely upon circumstances. Wealthy firms should bear the entire cost; in other concerns the scheme should be mutual.

To answer the objection of those who think that contributory schemes are a check on the mobility of the individual, the amount paid in by an employee should be available with interest upon his departure.

—ROY VERNON WADE, *Scotland.*

THE · NEXT · TOPIC

Belts, Foremen and Paper Work

ADVANCE QUESTION

Williams puts it up to the foremen to get him facts as to belt costs. Ed thinks it is the bookkeeper's job. Al feels that Williams wants more details than a cost man can give him. Is it the foreman's job?

Preventing Spoiled Work

IT SHOULD be a rule that foremen check all first pieces and blueprints. They are the persons at the strategic point to catch any spoiled work, and to remedy the cause in the shortest time. The foreman should make sure that the operators are not at fault, and if they are take such steps as will eliminate the cause.

Checking jobs is the foreman's most important duty, for if men put out work that is spoiled, or not up to standard, the foreman's effort for quantity and low cost will be wasted so far as that particular lot of product is concerned. —ALBERT LYON.

More Responsibilities for the Foreman

THE foreman is responsible for the work of his men, and our foremen have learned that there is no better method of controlling it than to watch the first piece. Only by this method can faults be remedied at the minimum cost.

Another feature of this method is that it forces contact of the worker with his foreman and every executive understands the value of such contact. With it, bad work can only result when both foremen and workers are neglectful.

My foremen consider this method as their most effective help, and would not like to have the inspection of the first piece made by an inspector. They hold that the one to inspect it is the one who is able to judge its quality, not only its correctness, and I think they are right. —FRANZ BERMANN.

Steel *versus* Cast Iron for Machinery Building

A discussion, by a number of authorities, on a point concerning which there has been indefiniteness among designers, and concluding that both cast iron and welded steel have individual fields of use

By Earle Buckingham

Professor of Mechanical Engineering, Massachusetts Institute of Technology

I AGREE to a large extent, with Mr. Davis' remarks, on page 211, Vol. 70, of the *American Machinist*, comparing cast iron and welded steel for machine tool construction. We all have the tendency to consider any value that is represented by a definite figure as a constant. A careful analysis will show, however, that there is practically no such value which is truly constant.

Young's Modulus is based on Hook's Law, and this law is based on perfectly elastic and homogeneous materials. As a matter of fact, we have no materials which are perfectly elastic and homogeneous. As a result, I believe that no material has a constant modulus of elasticity, but has one which depends upon the unit stress. This is very evident in aluminum, and probably holds true with cast iron and steel. The more perfectly elastic and homogeneous the material may be, the smaller this variation will be. I see no reason to take exception to, nor to question the statements of Mr. Davis in this respect.

He does, however, make the statement that rigidity and strength are the primary factors to be considered in the choice of materials for machine frames. This I cannot agree to as a correct general statement. To my mind, there are at least four physical properties and two economic factors that enter into the choice of a proper material for machine frames. These physical properties are as follows:

1. Rigidity.
2. Strength.
3. Inertia or mass.
4. Durability.

The two economic factors are as follows:

1. Cost of materials.
2. Ease of fabrication.

1. Rigidity. About the only virtue of rigidity in machine-tool construction is to maintain the position and alignment of operating members under load. For relatively slow moving parts, rigidity is often beneficial, but on higher speed mechanisms, if it were not for the elastic yielding under load, these mechanisms would soon hammer to pieces because of the inevitable errors in construction and the consequent impact loads of infinite amount. Some impact loads are always present, and the greater the rigidity of the restraining members, the higher the stress concentrations, and the stronger the materials must be to withstand them. Regardless of the material employed, the design of some machine frames is made to obtain the maximum of rigidity while the design of other frames is made to obtain sufficient elasticity. Considering rigidity only, steel would be the most favorable for designs of the first class while cast iron would be most favorable for designs of the second class.

2. Strength. Sometimes we need strength in tension, and at other times we need strength in compression. Rolled-steel plates and structural members are much stronger in tension than cast iron, but cast iron is much stronger in compression than rolled steel. Many machine frames have greater compressive stresses to withstand than stresses in tension. In such cases cast iron would be more satisfactory than steel.

3. Inertia or mass. An increase in the mass and inertia of machine frames is not always an unmitigated evil. The story is told of a designer who designed a new machine and reduced the amount of metal in the frame to the minimum required for rigidity and strength. This machine when constructed was unsatisfactory for many reasons. The owner of the plant then took the designer into the yard where there was a huge pile of pig iron, and said to him, "This is all ours, and you can use as much of it as you wish."

Increased inertia in machine frames reduces vibration in operation. A machine frame built up of welded steel, with any great amount of mechanism enclosed or attached, would also be much noisier in operation than a cast iron frame of greater mass. Furthermore, a frame of lighter section would respond more rapidly to expansion and contraction caused by changes in temperature than would a heavier section. As, in most cases, these changes in temperature are localized at certain points in the machine, as they are caused by frictional heat of operation or the position of the machine in relation to heating coils or sunlight, much larger changes in position or alignment are often possible from this cause than from deflection under load.

4. Durability. The durability of the material as measured by its resistance to wear is a very essential physical property for machine frames carrying sliding members. In this respect, cast iron is far superior to rolled steel. A lathe or planer bed with ways of rolled steel would soon lose its original accuracy.

We must also consider the durability as measured by the ability to stay out. It is very difficult to plane off one surface of a structural shape and have it remain straight. A well-seasoned frame of cast iron of equal strength and rigidity, but necessarily of greater mass, is much more satisfactory material to deal with. Furthermore, it is easier to obtain a seasoned cast-iron frame

with internal stresses practically eliminated than to heat-treat a piece of steel until it is in the same condition. In addition, welding operations usually introduce internal strains of little consequence in ordinary structural members, but of appreciable influence on a frame which must retain its straightness or alignment within extremely small limits. The economic factors are self-explanatory and require no further comment.

I believe that welded-steel frames can be used to advantage in machine-tool construction to a very much greater extent than at present. On the other hand I feel quite certain that cast iron will always have a very large field of usefulness in this same industry where its own peculiar qualities are most favorable to meet specific conditions. Welded-steel and cast-iron machine frames may thus become competitive in a relatively narrow middle range, on one side of which welded-steel frames are unquestionably superior, and on the other side of which cast-iron frames are unquestionably superior. On the whole, they should be considered complementary rather than competitive. The choice should be determined by the consideration of all essential factors and not from a part of them.

By Dr. George K. Burgess

Director, Bureau of Standards

REFERRING to our Circular No. 101, "Physical Properties of Materials," we find on page 84 a reference to Landolt Börnstein Physical Tables, 1912, indicating that the Young's Modulus of elasticity in tension and compression for cast iron varies from 10,660,000 to 14,920,000 lb. per sq.in. Another reference gives the value for gray cast iron as 12,000,000 to 15,000,000 and, unusually strong, 20,000,000. It is probably correct that the modulus of elasticity of cast iron decreases gradually as the stress increases.

We know of very little accurate information on the modulus of elasticity of cast iron. One reason for this is that tests of cast iron are not easily made, and if accurate extensometers, which are necessary to obtain accurate values of the modulus, are used, the instruments are liable to be badly damaged if the specimen breaks unexpectedly.

If an investigation is undertaken to obtain fundamental information on the modulus of elasticity of cast iron, it is very important that enough specimens be included to represent accurately all the different kinds of cast iron which are in commercial use in this country at the present time. We believe that, because of the variability of cast iron, no fewer than five duplicate specimens should be tested, the chemical analyses and metallurgical history should be known, and the other physical properties should be determined as well as the Young's Modulus of elasticity.

By H. F. Moore

Research Professor of Engineering Materials, University of Illinois

THE modulus of elasticity of steel of all grades covers a remarkably narrow range—rarely being lower than 28,000,000 lb. per sq.in., and rarely higher than 31,000,000 lb. per sq.in. In the case of cast iron there is much more variation. Moreover, since the stress-strain diagram for cast iron is a curved line, the value of modulus varies for different stresses. For working stresses for cast iron, values of the modulus vary all the way from 12,000,000 lb. per sq.in. to 20,000,000 lb. per sq.in., and, in general, the modulus is slightly lower in tension than in compression.

Steel is certainly much more rigid than is the ordinary foundry run of cast iron. However, this fact is partly compensated for by the fact that, since cast iron is much weaker than steel, it is necessary to use larger members of cast iron, and hence the stresses being lower, the total deformation is reduced.

The relation of the relative stiffness of a cast-iron machine part, as compared with a steel machine part for the same purpose depends both on the strength and the stiffness of the two materials. If the problem of strength does not enter into the design of the part, the rigidity of the steel part would be much higher. If the problem of strength does enter in, then the greater size of the cast-iron part required for strength would tend to make its rigidity more nearly equal to that of the steel part.

It is true that there are comparatively few data on the modulus of elasticity of cast iron. However, since this modulus varies over quite a large range, it would be necessary to determine the modulus of elasticity for each given lot of iron if the problem of rigidity were of great importance.

By H. W. Hayward

Professor of Materials of Engineering, Massachusetts Institute of Technology

CAST iron is such a variable material that it would seem impossible to make any very definite statements with regard to its properties. The tensile, compressive, and shearing strength, and the toughness vary with the kind of iron, the size and shape of casting, and conditions of pouring.

The action of cast iron under compression is different from that under tension. The properties under compressive stress vary with the length and cross-section of the specimen. A small, carefully fabricated casting made from a high grade of iron will show a much higher modulus of elasticity than a large casting from the same material.

It would seem that if any figure is to be proposed for general use the value suggested should be low enough to allow for all possible variations. It should be carefully noted that the stress-strain curve for cast iron is not exactly straight for any great distance. The compression curve is approximately straight for over a greater range of stress than is the tension curve.

In view of these facts, and also of the fact that cast iron has no definite elastic limit or yield point, great care must be taken to use a figure for "*E*" that is low enough to be safe.

The following quotations from Mills' "Materials of Construction," third edition, pages 331 to 333, agree very well with results obtained at the Massachusetts Institute of Technology on the ordinary run of iron:

"Cast iron will exhibit a great variation in elastic properties, since so many factors affect its strength. For the typical irons shown (in the book) the ultimate (tensile) strength is 35,000 lb. per sq.in. for the hard gray iron, 22,500 for the average gray iron and 16,000 for the soft gray iron. No constant proportionality of stress to strain exists for any considerable load interval and, therefore, it cannot properly be said that cast iron has a modulus of elasticity. If we consider, however, that the term may be applied to the ratio of stress increment to corresponding strain increment for successive small load

intervals, we find that the value of E is initially about 30,000,000 lb. per sq.in, for hard cast iron, 24,000,000 for average iron, and 14,000,000 for soft iron. At 5,000 lb. per sq.in. stress, the values of E have decreased to about 20,000,000; 15,000,000; and 7,000,000 respectively. At 10,000 lb. per sq.in. stress, the values of E are about 15,000,000 for hard iron, and about 14,000,000 for average iron.

"The yield point is much more clearly marked in compressive tests of cast iron than in tensile tests, although no absolutely constant ratio of stress to strain is maintained for any considerable load interval. The ultimate compressive strengths of the three irons (shown in the book) are 93,000, 63,000, and 44,000 lb. per sq.in. for hard, average, and soft irons, respectively. The moduli of elasticity at 10,000 lb. per sq.in. stress are about 30,000,000, 20,000,000 and 12,000,000 for the three classes of iron while at 20,000 stress the values of the moduli have dropped to about 25,000,000, 16,000,000 and 8,000,000 respectively."

Semi-steels and very carefully made iron will hold the high initial modulus to a much higher stress than the common irons do, but our experience indicates that great care must be exercised in inspection to take advantage of this fact.

By C. F. Hirshfeld

Chief of Research,
The Detroit Edison Company

THERE are recorded very carefully made tests on cast iron which indicate that the modulus of elasticity may vary between a figure very close to 19,000,000 as an upper limit and a figure close to 12,000,000 as a lower limit. It is commonly assumed that the modulus of elasticity for steel varies between 28,000,000 and 31,000,000 and most work is done on the assumption of 30,000,000. These figures would indicate a ratio for steel to cast iron equal to something like 1.6 to 1 for the best grade of cast iron under low tensile loads, and a ratio of the order of 2.5 to 1 for the weaker grades of cast iron.

By A. V. de Forest

Research Engineer,
American Chain Company

THE conditions of test, such as the length of time under load, the number of times the load has been applied, the amount of such load, and the accuracy with which the specimen is located in the grip, seem to be unknown in all published tests on cast iron.

I have a feeling that if someone should carefully make repeated-load stress-strain diagrams of cast iron, the curvature of the diagram would be found merely as an indication of unequally distributed stress. I know that this is the case in wire where there is a similar shape of stress-strain diagram.

Another Authority

THE modulus of steel is not 30,000,000, but runs from somewhat under 28,000,000 to as high as 32,000,000, and no one may predict what it will be in any individual case. It does not seem to me that this variation is particularly less than that which the article discusses in the case of cast iron.

Furthermore, it is all a matter of design adjustment. The deflection of a beam varies with the first power of the modulus, but with the cube of the depth in the case of a rectangular beam or the fourth power of the diameter in the case of a circular beam. An adjustment in diameter or depth to take care of the difference between the modulus of steel and cast iron is not a particularly serious matter. In the automotive field, aluminum has largely been used in such things as engine bases instead of cast iron, and the modulus of aluminum alloys is somewhere in the order of 6,000,000 to 10,000,000, depending on the alloy. Everybody knows what cast iron is good for, and what steel is good for, and they both have their field.

Some Tricks of the Trade

By O. A. Schneider

EVERY time I come across an article describing work out of the ordinary that some one has done, it reads like a description of the latest types of tools and machines. Why should it be such a stunt to make or repair something when you have all the tools to do it with? For a change, I will tell you about some things I have had to do, with hardly anything but my head and my hands.

Once I met up with a 500-hp. Buckeye engine. The firm had bought it second hand and installed it without overhauling it. When I looked it over I told them it would get worse instead of better, and sure enough it did.

Finally they asked me if I could fix it, and I told them I could. So when they shut down for inventory I started on it. The bearings were 9 in. in diam. by 18 in. long, and as we had no crane to lift the shaft we had to turn it in place. It took two days to rig up and one to do the turning.

We then rebabbitted the bearings, and ran them in under the engine's own steam. We also changed it from compound to simple and had it ready to run when they were ready for it.

At another shop, in Lock Haven, Pa., they had a $4\frac{5}{16}$-in. diam. shaft out of balance so much that it made the windows shake. The superintendent asked me what I thought could be done about it, and when I told him it could be fixed easily, he said: "I will shut the mill down and give you all the help you want; go to it!". I used two 6-in. blocks, four wedges, some 6-in. timber, a jack screw, and a $1\frac{1}{2}$-lb. hammer. There was no power to straighten it so I had to peen it, and I struck it right the first time. The "super" was so tickled he handed me a five dollar bill out of his own pocket, and they have to be tickled a lot to do that.

Boring a Valve Cylinder by Hand

The next tough job I tackled was at a rolling mill in Newport, Ky., where I bored a valve cylinder 10 in. diam. by 48 in. long, by hand. I used a piece of $3\frac{15}{16}$-in. shafting for a boring bar, and fastened a piece of threaded stud material $4\frac{1}{2}$ ft. long to one end, this and a nut being all the feed I had. It took me one day to fit up, then I took a roughing cut one day and the finishing cut the next with nothing but a cross-bar and a couple of colored helpers for motive power.

The only thing I get stuck on is gears, but talking about gears, I made a steel gear twelve years ago that is running today. The broken one belonged to an out-of-date machine and was 6 in. in diam. and 1 in. pitch. I made a new one in three days on a small planer using a formed tool. It took a long time, but they did not mind that, as long as they got it.

Centralized Records for Efficient Tool Control

By N. J. Bowne and N. Holve

Detailed operation of the toolcribs—Methods of repairing, maintaining, replacing and reclaiming tools—The net results of the entire plan

TOOLS used in more than one department are stocked in the master toolcrib and a sub-stock is carried in each departmental toolcrib. Tools used in one department only, are stocked in that department's toolcrib. As has been mentioned already, the tool records furnish each department using a tool with a location card. The primary purpose of this card is to notify the production - department foreman that the tool order has been started in the toolroom, and when it is due, enabling him to plan his production accordingly. The location card is placed in a tickler file under the date the tool is due. When the tool has been received and located in the toolroom, the correct location is entered on the card. Tools are located according to classification, therefore, the crib attendant very seldom has to refer to the location card. Anyone familiar with the classification system can find a tool without referring to a record. The benefit of this is apparent, as any crib attendant is just as good in one toolcrib as another, after he has been broken in on the general plan.

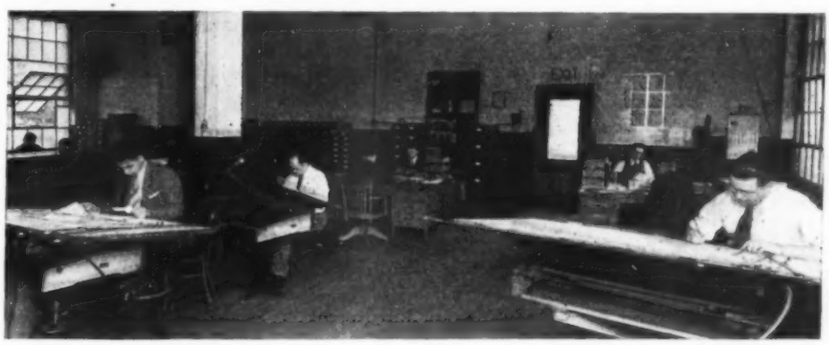


Fig. 12 — A corner of the tool-control department. Here the actual control of all small tools, from designing to scrapping, is centered

For each operation on a production part, the tool-record division furnishes a tool list, Fig. 13, containing all tools to be used on the operation. When a new tool-location card is received, the crib attendant enters the tool number on this operation tool-list. He now has a complete cross-index and can find all information desired, as the location card is filed by the tool number and the tool list by the part and operation number.

The following is the procedure when tools are required for an operation: The layout clerk in the foreman's office makes out a toolcrib notice and check, Fig. 14, showing the part name, the part number, the operation name, the operation number, the man's name and his number. This notice is referred to the crib attendant, who takes the tool list for this operation from the file. For each man, a quantity of tags stamped with his number is available on a board provided with individual hooks for all the men. The crib attendant takes as many of the man's tags as there are tools on the tool list. As he takes each tool from the bin, he inserts one of the tags in back of the bin label in such a way that the man's number is visible.

All the tools are placed in a box and are held in readiness to be delivered to the operator, who signs the notice originally made out by the layout clerk. This notice is filed in the part-number file, by operation, and the tool list is filed by the man's number. This procedure establishes a very complete cross - index and checking system with very little clerical work. When the tools are returned, they are checked, re-sharpened, if necessary, and placed in the proper bin. The man's tag is removed from the bin label-holder, the tool list is moved from the man-number file back to the part-number file, from which the man's original receipt is removed, stamped "Tools returned" and either destroyed or returned to the man.

Whenever a tool is used in one department only, the following order points are established: *(a)* Danger point, *(b)* order point, *(c)* maximum balance allowed.

(a) The danger point consists of four weeks' reserve, plus one tool, and is a point of investigation from the

PART Tread Wheel NO. 4798 OPERATION Grind O.D. NO. 11
DWG. NO. L-208 DEPT. NO. 14 MACH. B & S SIZE #10

PIECES ON HAND	NAME	PCS. USED	SIZ.	SYMBOL	LOCATION
	Mandrels	2		522143	
	Driving Dogs	2	1/2"		
	Micrometer		25m/m		
	Adj. Snap Gauge		1"		
	Alundum Wheel	1	12"x1"x 5"-60L	815306	

When the tool list is not correct, please report the error at once to the Tool Control. DATE 12-31-24 SIGNED Merritt
TOOLS CALLED FOR ON THIS LIST MUST BE ISSUED TOGETHER
Form P.11364-8-28-30P Printed in U.S.A. TOOL LIST

Fig. 13 — The tool list

The fourth and concluding part of the article.

crib attendant when tools are taken from this danger point.

(b) The order point is the quantity necessary for normal production, including duplications for sharpening, plus the danger point.

(c) The maximum balance allowed is the order point, plus six months' usage.

When the stock in the crib, including tags for tools on the floor, is below the order point, the crib attendant makes out a requisition for the tool, but no quantity is given. The foreman either approves the requisition or suggests reducing the order point, depending upon conditions with which he is familiar. For instance, if the schedule on the particular part on which this tool is used is decreased, it is possible that the foreman will use

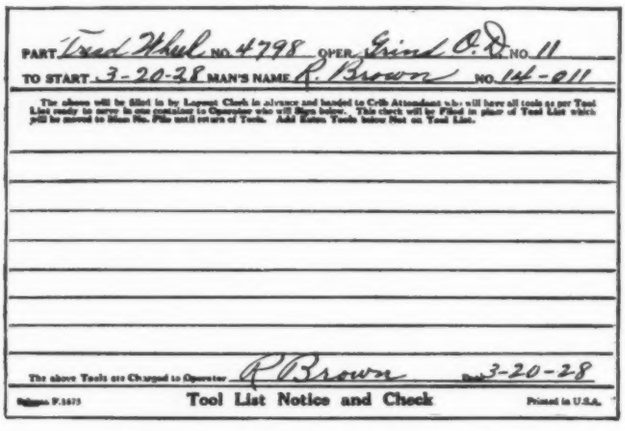

PART Tread Hub NO. 4798 OPER. Grind O.D. NO. 11
TO START 3-20-28 MAN'S NAME R. Brown NO. 14-011
The above Tools are Charged to Operator R Brown Date 3-20-28
Tool List Notice and Check

Fig. 14 — Toolcrib notice and check

less machines for this operation, or he may have an improvement in mind that will render this tool obsolete. The foreman's approval, therefore, is very important as a protection against placing orders for tools that may become obsolete in the near future.

The requisition is sent to the tool records, where the stock condition is entered upon it from the balance card in the master file. When the tool-record supervisor approves the requisition, he enters the quantity to order, based upon previous usage or possible demand. The amount to order, plus the stock in the crib, however, must not exceed the maximum balance allowed. After the tool supervisor's approval, the order is placed as previously described under the procedure of issuing orders.

Tool sharpening is done in the toolcribs throughout the plant. Tools requiring more difficult sharpening and small repairs are sent to the master toolcrib, where suitable machinery is available. Tools requiring complicated repairs are sent to the toolroom. Tools sent for sharpening or repair must be accompanied by an equipment-repair requisition, Fig. 15. The sub-foreman or the crib attendant makes out the requisition in triplicate, giving a complete description of the work to be done, the date wanted and a reasonable time allowance for the job. The original copy (pink) is kept in the tickler file under the date wanted, and a check is placed back of the bin label, showing whether the master toolcrib or the toolroom is making the repairs.

The duplicate (white), the triplicate (buff), together with the tools, are sent to the master toolcrib, or to the toolroom, where the sub-foreman or the layout clerk lays out the work and estimates the time allowed. If the total of this estimate exceeds the time allowed by the department requesting the repair, the situation is taken up in order to prevent spending too much time on a tool that may be beyond repair. The duplicate is filed by the tool-department clerk and each time card is posted as on regular orders. Time exceeded is reported in the same way. The triplicate remains with the work, and the inspector enters his report upon it when the work has been completed.

The time taken for each operation is entered from the duplicate onto the triplicate, which with the total time computed, is sent to the department with the tool. The duplicate remains in the department doing the work and is filed by the tool number.

When the tool is received, the foreman has a complete picture of the repairs on one record, and he can compare his and the toolroom's estimate with the actual performance before approval of the repairs. The original is removed from the tickler file and is filed by the tool number in the toolcrib, thus giving a permanent record regarding the repairs to the tool.

The triplicate, after being approved by the foreman, is sent to the tool control where, in case of large repairs, it is entered on the master tool-record. If the time allowed is exceeded by 25 per cent, the matter is referred to the tool supervisor. The card is finally filed by the tool number. This form and procedure may seem complicated, but *it works*. The personnel of the operating and repair departments is interested in the estimated and the actual performance, so that the apparent complications melt away under interest and cooperation.

Clearing the records of scrapped tools is given proper attention in the plan. When a tool comes back from the floor broken or worn beyond repair, it is scrapped and sent to the master toolcrib on a tool replacement-issue and scrap ticket, Fig. 16. This document is always used when tools are drawn from the master toolcrib for replacement, but the same quantity of scrapped tools must always be returned. This document is not used for new or additional tools, however.

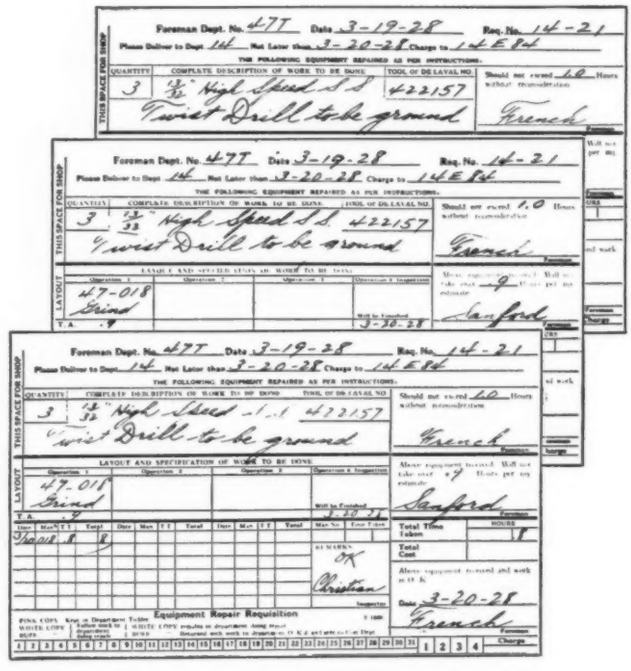

Foreman Dept. No. 47T Date 3-19-28 Req. No. 14-21
Please Deliver to Dept 14 Not Later than 3-20-28 Charge to 14E84
THE FOLLOWING EQUIPMENT REPAIRED AS PER INSTRUCTIONS.
QUANTITY | COMPLETE DESCRIPTION OF WORK TO BE DONE | TOOL OR DRAWING NO. | Should not exceed 10 Hours without reconsideration
3 | 17/32" High Speed S.S. Twist Drill to be ground | #22157 | French
LAYOUT AND SPECIFICATION OF WORK TO BE DONE
47-018 Grind
Equipment Repair Requisition

Fig. 15 — Equipment-repair requisition, which is made out in triplicate

The procedure of a tool replacement-issue and scrap ticket is as follows: The toolcrib attendant makes out the document in duplicate, filling out the top part with the date, department, charge number, quantity and cause for scrapping, tool number and quantity ordered.

The document is signed by the sub-foreman or the crib attendant and both copies, with the scrapped tools, are sent to the master toolcrib. The storekeeper fills in the quantity delivered, signs and sends the original (white) copy to the tool records, where it is entered on the balance card in the master file. From the tool records, the original is sent through distribution as a regular issue. The scrapped tools, with the duplicate (canary) copy, remain in the master toolcrib until disposition of the scrap is actually made.

If any of the tools can be reclaimed at a reasonable cost, it is done on one of the standard orders issued to cover reclaiming each of the ten general classes of tools. The new tool number and the time taken are entered in the space for reclaiming. After the reclaimed tool has been inspected, it is delivered, as a rule, to the master toolcrib, from where it is issued instead of a new tool, as soon as required for the particular job.

The document is sent to the tool records and entered as a store receipt in red ink on the balance card for reclaimed tools, which card is inserted on top of the regular balance card in the master file. The card and the document are priced at a value of 50 per cent of a new tool. As this value is credited to the standing order that is charged with the time for reclaiming, we are in position to determine at the end of each period which of the classes of tools are economical to reclaim and which are not, on the basis of 50 per cent valuation for a reclaimed tool.

The man record's previously referred to, serve primarily the purpose of laying out the work for the man in the tool room. These records are also used for statistical information, regarding the men, and as efficiency reports. For each employee in the tool department, a man-record card, Fig. 17, is typed in duplicate. One copy is filed by man number in the tool control and the other one in the toolroom. When the estimator lays out an order, he inserts a small tab containing the order number, operation number, time allowed and the date on which each operation should be completed. When the finished time-card is posted, the tab is removed from the man record.

Each week, the tabulating division tabulates a man-record report for the toolroom, showing: The man number, order number, time allowed (detail and total), time taken (detail and total). The total for each man is entered on the man-record card with a division between productive and expense hours.

The man's efficiency is calculated by the following formula:

$$\frac{\text{Time allowed}}{\text{Time taken}} = \text{Efficiency}$$

The tool is calculated each month and the accumulated total and the average are carried forward. The toolroom copy is used in a similar way, so far as layout of the work is concerned. Lost time and hours on production, or expense, are entered from the time cards in order to check that the man is credited with the correct time of 48 hours

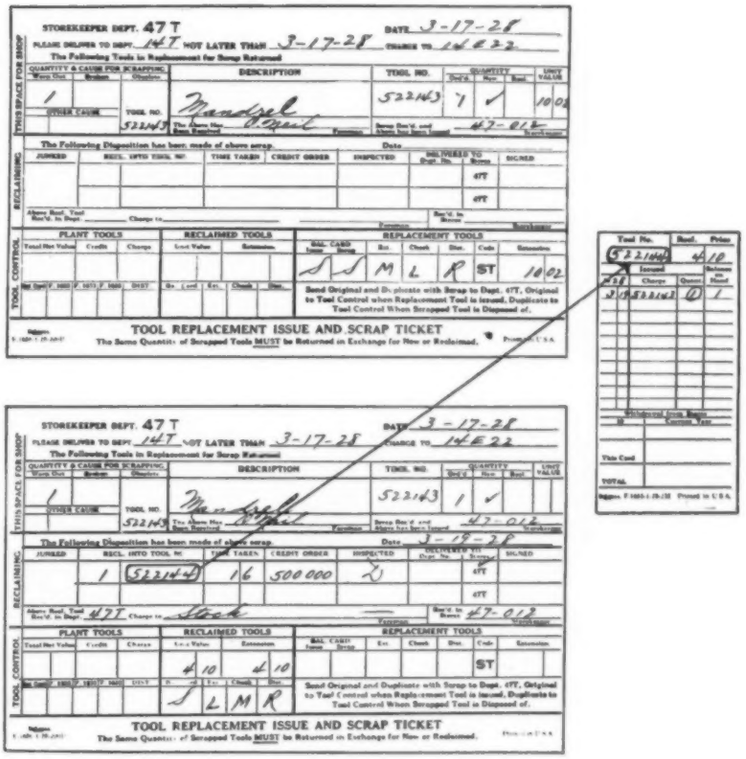


Fig. 16 — Tool-replacement issue and scrap ticket

per week. At the end of each month, the toolroom copy is sent to the tool records, where the total lost time is entered and the time taken is checked against the time entered from the tabulated man-record report.

When the total-control copy is completed each month, it is referred to the estimator and to the tool-record supervisor, who brings unusually low efficiency to the tool supervisor's attention. The grand total from the tabulated weekly-report is entered on a summary of man records, which is referred to the tool supervisor at the end of each month. This summary also contains a summary of tool-orders issued and work available in the toolroom, based on hours estimated and work actually performed, as per the weekly man-record report.

Each month, the tabulating division furnishes a report showing the labor and material charges to repair and maintenance of tools. This report shows the department charged and the department performing the work. If desired, we can at any time allocate this information to any particular class of tools, as the expense number for the repair and maintenance of tools indicates the main class, as per the tool classification already described.

All labor and material charged against tool orders is charged to the tool-process account. The report of tool orders closed during each month is credited to this process account and is charged to the following: Plant tools to the plant account. Other tools to the small-tool stock account. Tools delivered to departmental toolcribs are credited to small-tools stock account, and are charged direct to expense by the distribution of the stores issues. Purchased tools are charged to the small-tools stock account, which is credited as they are issued. The original cost of plant tools is charged to plant account. Each year, depreciation based on the following scale is charged to expense and credited to reserve for depreciation account: First year, 10 per cent; second year, 20 per cent; third year, 20 per cent; fourth year, 20 per cent; fifth year, 20 per cent; sixth year, 10 per cent; total 100

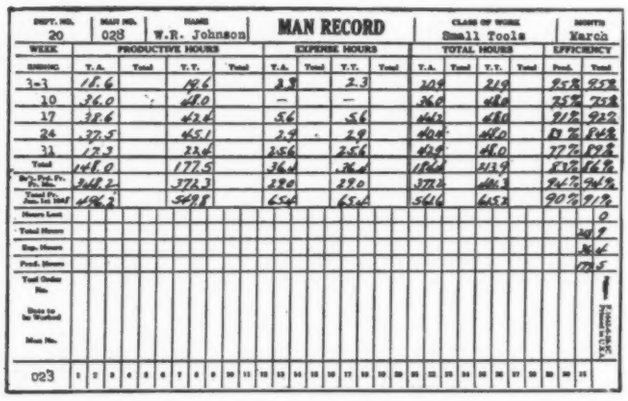


Fig. 17 — The man record

per cent. After the sixth year, the original cost is credited to the plant account and is charged to reserve for depreciation. If before this time a tool is scrapped, the plant account is credited for its full value and the difference is charged to expense. This information is readily obtained from the tool depreciation record.

An inventory of plant tools, by department, can be compiled in a few hours, as these records are "Kardexed." An inventory of the small-tools account can be taken direct from the control account in the bookkeeping division, or from the master record, in a few hours. Physical inventories are, of course, perpetually maintained and the necessary adjustments are taken care of currently. One of the main features of this system is the possibility of control through the records. By having most of the records Kardexed, we have the benefit of unlimited means of flashing the facts by using signals of different colors. Some of the signals have been described in connection with the details of the records. The most important signal system, however, is operated between the part-number cross-index and the master tool-record file.

In order to be kept up-to-date regarding the part numbers, a duplicate of the change in order-point slip, covering manufactured parts, is always furnished to the tool control by the planning department. This slip is filed in back of, and in the same pocket as, the tool list in the part-number cross-index. If a change in order-point is received, showing order points 0-0, a yellow signal is placed over the tool number for each tool listed on the tool list for this part in the master tool-record file. This serves as a cautionary signal until the tools have been investigated, or reduced, if the tools are still used on other live parts. If for any reason a requisition should come through for such tools, it will be given special consideration whenever the balance clerk sees this large, bright-colored signal over the tool number.

In the same way, if a revised master route-card is received, in the tool control from the time-study department, with, for instance, an operation eliminated, tools for this operation are flashed immediately with a blue signal. If through any other authorized source a tool is found to be obsolete, an orange signal is inserted immediately and remains until disposition is made of the tools. The benefits of this feature of signaling the facts is apparent. There is hardly anything that can happen to a tool, or a part affecting the tool, without its being shown instantly in the master tool-record file.

It is now about sixteen months since the inception of the tool-control organization. During this time, regular production has not materially changed, and we have decreased the expenditure for tools $70,000 as compared with the previous sixteen months. In this reduction is included the expenditures for plant tools, short-lived tools, repair and maintenance of tools and any unabsorbed overhead of the toolroom. The saving during the first twelve months amounted to $50,000 under the reorganized plan. In arriving at these figures, all organization expenses have been included, and it must be remembered that the renumbering of all tools in the plant in accordance with the new classification system, added considerably to this expense. The savings would have amounted to very much more if this large task had not been undertaken. However, a very important feature connected with the renumbering, was the close analysis made of each tool before it was properly classified and renumbered. Without the classification system, the standardization and simplification that are being worked out, would not have been possible.

Our tool inventory, of which 95 per cent was expense tools—tools estimated to last on an average of but one year and which are not repairable—for many years has exceeded $100,000. It is now in the neighborhood of $35,000 and includes a surplus of tools over the immediate requirements to a value of about $10,000. In a year or so, this inventory will not amount to more than $25,000, or less than 25 per cent of the amount tied up before the inception of the centralized idea.

Between $5,000 and $6,000 has been spent for visible filing-equipment. When the renumbering has been completed (it stands now at about 80 per cent) the reduction in clerical help under the new plan as compared with the old plan, will pay for the additional filing equipment in two years. Under the old plan of scattered records with but little or no control, due to the various parties interested being primarily concerned with regular production, we had the equivalent of seven clerks fully occupied with work connected with tools. Under the present plan, four clerks will be sufficient to carry on the work.

Large Savings Possible

The possibilities for indirect savings from simplified and standardized designs, elimination of inefficient operations and unnecessary tooling, all of which can be brought about by close co-operation between the engineering, design and tool-control divisions, are so great that the net result will probably greatly exceed the actual figures we are able to point to at present in the accounts covering the tool expense only. Any management can well afford to study the conditions in its organization, with the viewpoint of establishing an efficient tool-control based upon the principles of centralized records and responsibilities. This is especially so where conditions involving several departments that have grown with the business, but where the lines of responsibility have become obscure, have existed for several years.

Perhaps it is idle to state that the system described in this article is exactly like any other system, in that it will not run itself. Also, its value is, and will continue to be, measured by the efficiency of the personnel operating it and the degree of co-operation between all departments concerned, especially between the recording and the operating divisions of the tool control.

In hardening the newer cobalt steels used for magnets, the oil-hardening type, usually containing 35 per cent cobalt and 5 to 6 per cent chromium, are first air cooled from about 2,150 deg. F., reheated to 1,380 deg. F., air cooled, and quenched in thin oil from 1,650 degrees.

Erecting-Shop Tools

from a Canadian Railway

Some practical labor-saving devices for locomotive erection that save time and promote safety

AT STRATFORD, ONT., is located one of the main repair shops of the Canadian National Railways, where complete major overhaulings are carried out for passenger and freight power. Although the erecting shop is equipped with standard forms of tools, such as cylinder boring rigs and similar devices, there are many operations where home-made tools find a use.

A convenient form of pit jack is used to support unwheeled locomotives on the pit, thus eliminating the use of blocks. Although blocks are satisfactory as far as rigidity is concerned, there are times when they are cumbersome and hard to fit in place, since no adjustment is available. Fig. 1 shows a locomotive being lowered on a set of the adjustable jacks. Both jacks are of the same design but the jack *A* shown at the rear is taller and is used to support front ends.

Constructional features of one of the jacks are shown in Fig. 2. The frame, made of cast iron, has a slide machined in its upper face to accommodate the screw jack supports. An opening through the frame allows sufficient clearance for the screw adjustment when the minimum height is required. When in use the supports are merely spread apart to the proper center distance and the weight of the load holds them firmly in place. Aside from being an efficient form of tool, the jacks are valuable from a standpoint of safety.

A device for pulling in cylinder bushings is illustrated in Fig. 3. The unit consists of a bar that is passed through the cylinder bore and bushing, after the latter has been started in place, support of the bar being from two plates *A*, one of which bears against the cylinder and the other against the projecting end of the bushing. Tension is taken up by the nut *B* through the collar *C* and a coil spring. The operating end of the bar is made with a square shank on which is located the ratchet wrench *D*. The wrench is operated by the air cylinder *E*, made from the steam end of a 9½-in. air pump. On the piston rod of the air cylinder is attached a connecting arm having several holes in it, so that the connection to the ratchet wrench can be made to suit the height of the center line of the locomotive cylinder and bushing. The air pump cylinder rests on the floor when the device is in use, and a chain is wrapped around the nut *B* and attached to the frame of the engine to prevent the nut from turning as the bar is revolved.

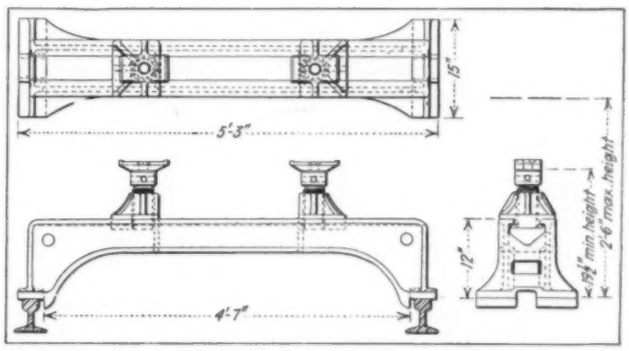


Fig. 2 — Constructional details of one of the adjustable jacks showing how it is located between the pit tracks. Three or four such jacks are used to support a locomotive after it has been unwheeled

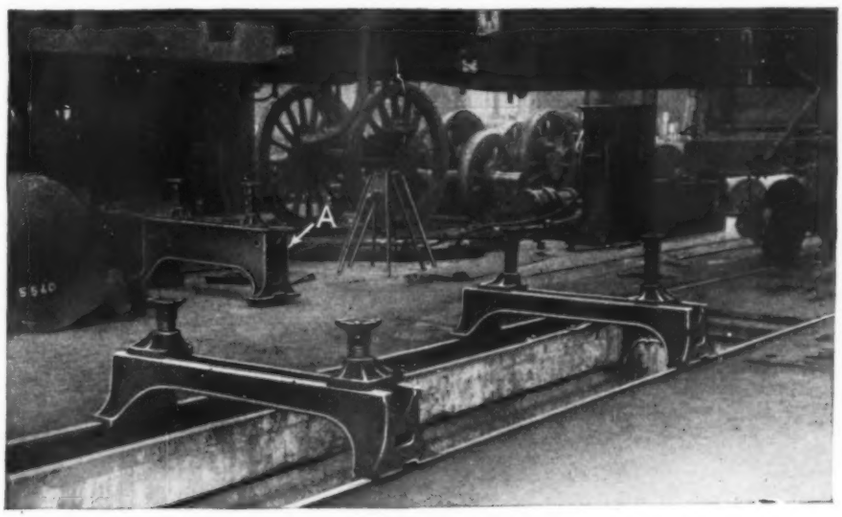


Fig. 1 — Adjustable jacks, made of a cast-iron frame and two jack supports, are used in the erecting department to support engines located on pits. The jack shown at the rear supports the front end

The bar is 99 in. in length, the body being 84 in. long and 4½ in. in diameter, and threaded at the end with three square threads per in. for a distance of 50 in. The plates are 14x36 in. in size and 2¼ in. in thickness, having center holes 5¼ in. in diameter into which steel bushings are inserted in order that the bar can revolve readily as well as have ample support.

In Fig. 4 are shown constructional details of the ratchet wrench. The wrench dog *G*, and the spring pin *H*, are made to permit opera-

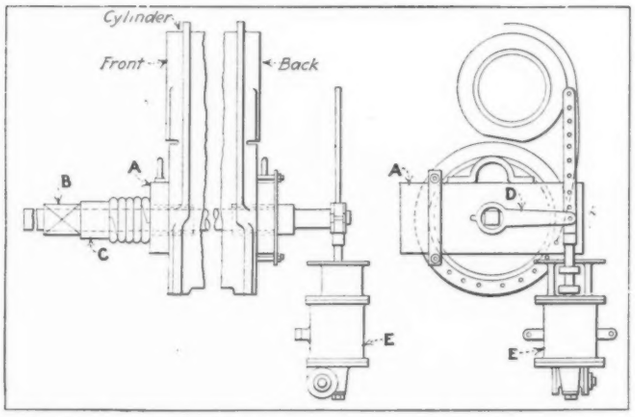


Fig. 3 — Cylinder bushings are drawn into place by two plates and a lead screw that is operated by a rachet wrench. Power to drive the wrench is delivered by an air-operated cylinder

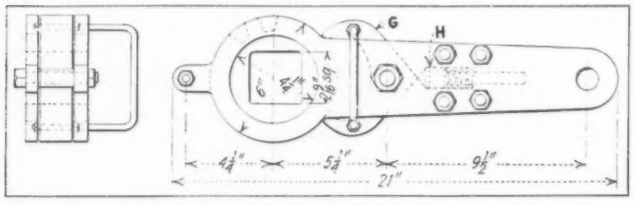


Fig. 4 — The ratchet wrench used in connection with the device for pulling in cylinders is arranged with a dog and a pin that permit operation in either direction

tion of the wrench in either direction, since a reverse motion is needed to release the pulling pressure after a bushing has been drawn into place. The ratchet wheel has 12 teeth evenly spaced, and cut with a 3-pitch gear cutter to a depth of $\frac{11}{16}$ inch.

A convenient form of rivet heater is used in connection with locomotive erection, the unit being portable as shown in Fig. 5. It is oil-fired and the air pressure for operation is from the shop air line. Details of a similar unit, made with the tank in a vertical position are illustrated in Fig. 6. A reducing valve *A* is used to limit the air pressure entering the tank in order that it will not exceed 25 lb. per sq. inch.

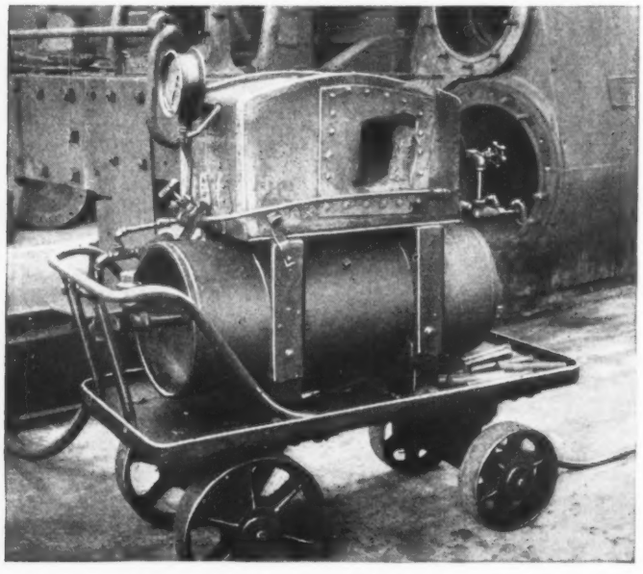


Fig. 5 — Rivets used in connection with erection work are heated in a portable oil-fired furnace. The furnace receives the operating pressure from the shop airline and can be transportated close to a locomotive requiring riveting

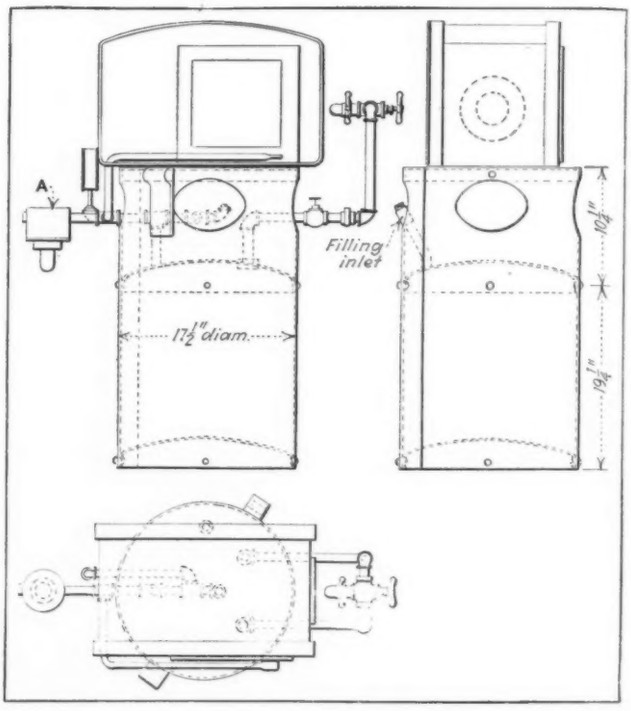


Fig. 6 — Details of a rivet heater showing the air intake provided with a reducing valve to limit the pressure

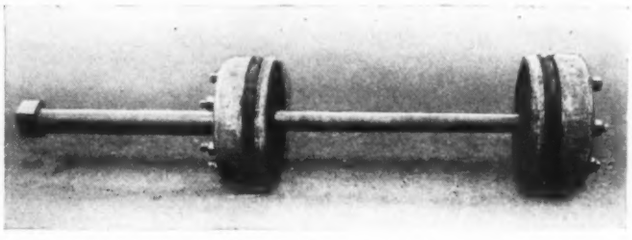


Fig. 7 — A device for testing superheater headers and steam pipes without the necessity of removing them from the engine

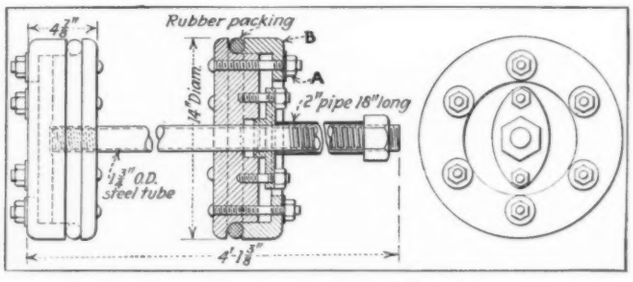


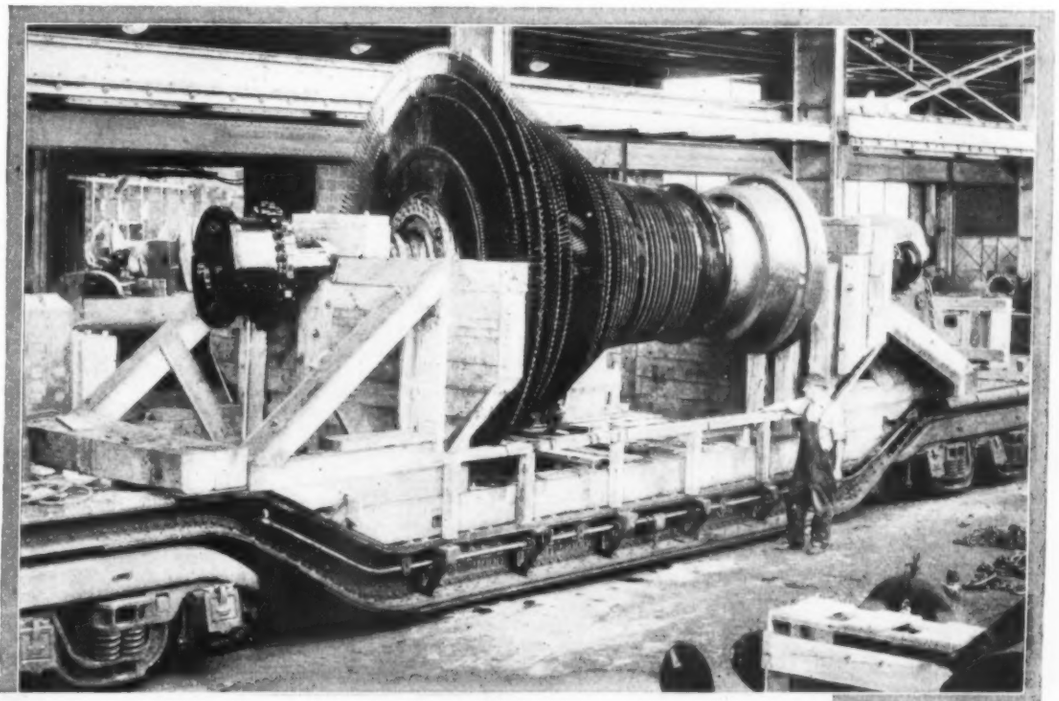
Fig. 8—Details of the superheater tester showing the two sealing sections that form a water-tight connection when the rubber packing is compressed

Superheater headers and steam pipes are water-tested by the device shown in Fig. 7, which is fitted into the steam chest and sealed so that the port openings in the valve-chamber bushing are closed off. The device permits a test to be made without removing the various units, thus saving considerable time. An assembly view of the testing device arranged for a 14-in. bore is shown in Fig. 8. After it is inserted into the valve chamber bushing to the correct location the sealing sections are adjusted by tightening the nuts *A*, causing the cap *B* to squeeze the rubber packing against the chamber wall.

Shipping Heavy Machinery

THE problem of transporting a completely bladed turbine of large size by rail to a distant point was complicated by the refusal of the railroad companies to accept any load with a width in excess of 11 ft. 9 in., including boxing. This particular rotor measured 12 ft. 2 in. in diameter at its large end, but by loading it diagonally it was possible to bring the width of the crating within the railroad requirements. This method of loading threw the weight off center and it required an additional weight of 54,000 lb. to balance the car.

Photographs by courtesy of Westinghouse Electric & Manufacturing Company

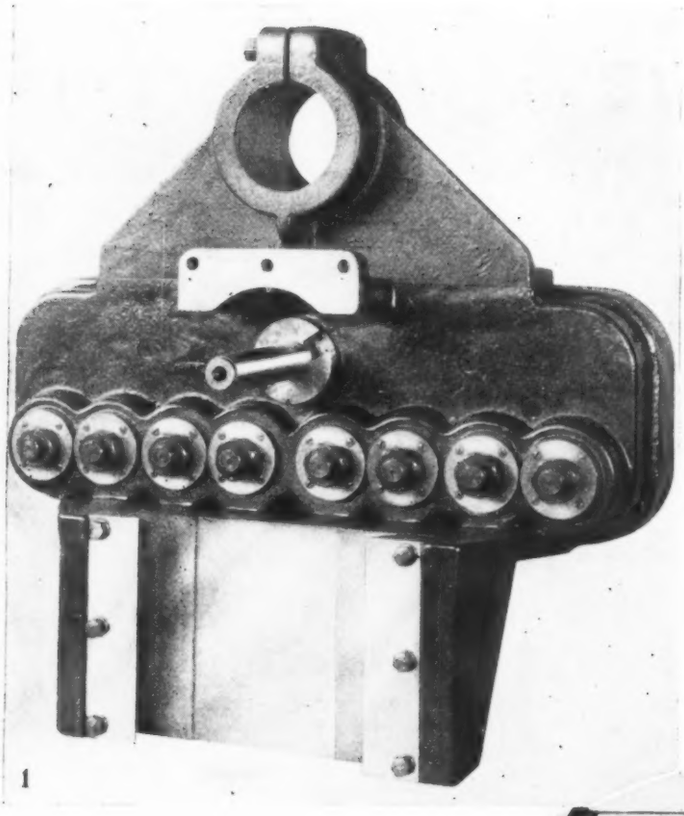


The turbine rotor at the right is one of the largest ever built. Its greatest diameter is 12 ft. 2 in., its overall length is 24 ft., and its weight 110,980 lb. As finally arranged with heavy timbering and crating the load weighed 191,000 lb. Maximum height from the rail was 15 feet.

When the spindle was ready for shipment, a well type of car, having a capacity of 210,000 lb. was secured from the railroad. A specially constructed skid was then built and fastened to the car by means of steel rods and bolts. As can be seen in the photograph on the left, heavy beams and bolts were used but the extra cost of packing was warranted to insure against movement on the trip, which lasted eleven days

Unit Tool Heads on Standard

THERE seems to be a rather widespread application of unit tool heads for use on standard machines as a means of reducing machining costs. These heads give advantages at a lower investment that may compare with those obtained from special machines, with the possibility of changing to a new design at a much lower cost than as if the whole machine must be discarded, or rebuilt. The unit heads shown have been designed and built for specific jobs in the automotive field. It will be noted that guide pins and bushings are used in each case to insure alignment of the bushing plate and the part holding the work. It is believed that these unit heads will suggest other uses.



1

Fig. 1—Eight-spindle head with roller bearing spindles for milling clearance in cylinder heads. Bearings have end adjustment for wear of cutters

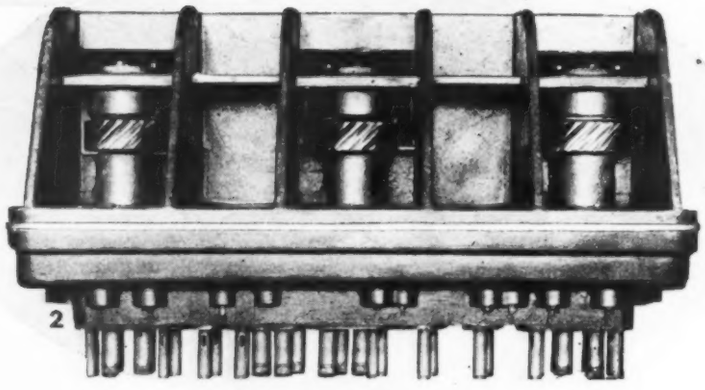


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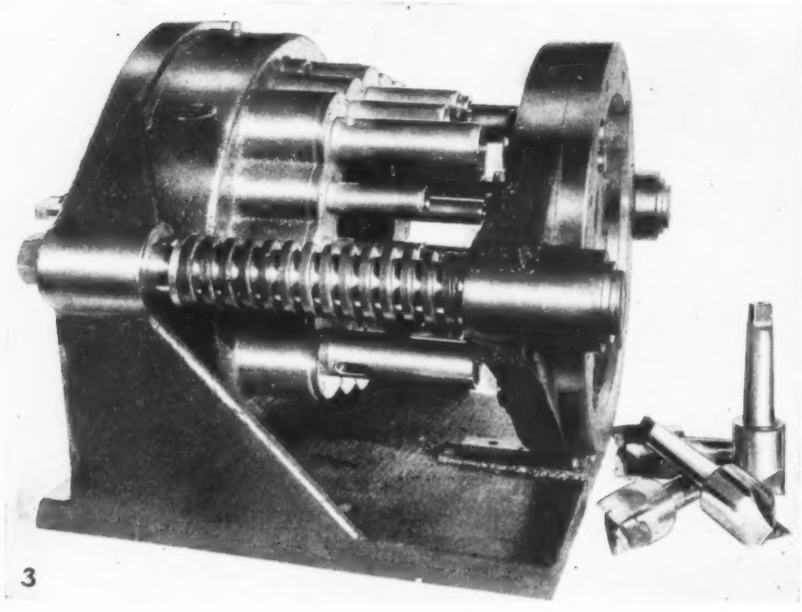
Fig. 2—Multi-spindle head to fit on "Hole-Hog" drill for drilling and countersinking holes in brake bands. The gear trains are driven from the three gears shown



3

Fig. 3—Head for drilling and cutting "half-moons" in axle-flanges. Head is mounted on lathe bed and axle is fed to cutters. Flange locates in the hardened ring

Conserve Time Machines

Photographs by courtesy of H. R. Kruger & Company, Detroit

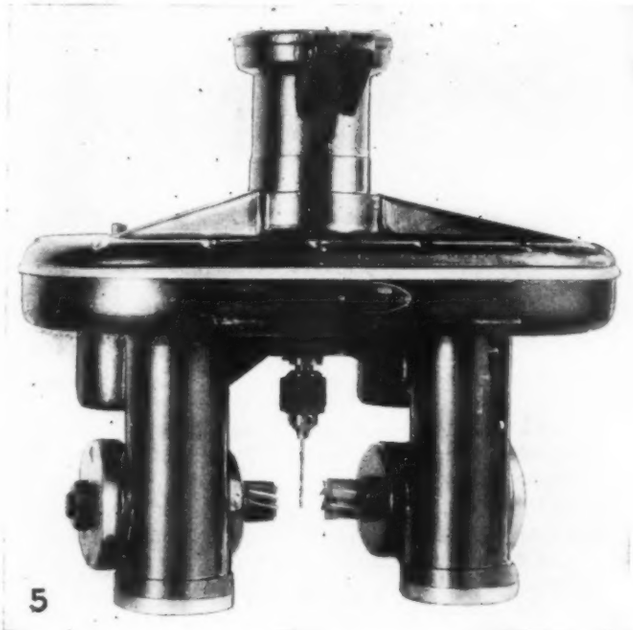


Fig. 5—Combined milling and drilling head for carbureter work. Both drill and cutter spindles run at proper speeds. Milling spindles adjustable for wear of cutters

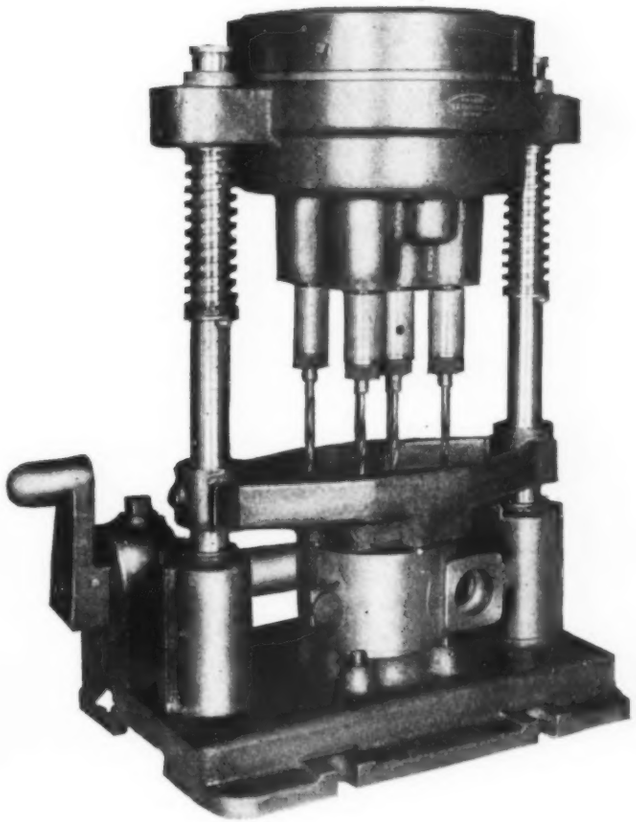


Fig. 4—Six-spindle drilling head for refrigerator compressor. Locates and clamps work quickly. Piece is centered by plugs and squared by cam at back

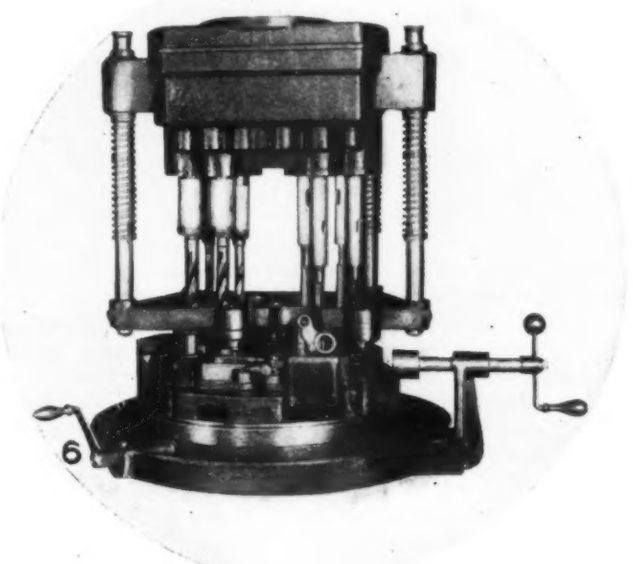


Fig. 6—Tapping head with leadscrew geared direct to spindle. Taps spark plug holes in four cylinders at once and insures correct lead

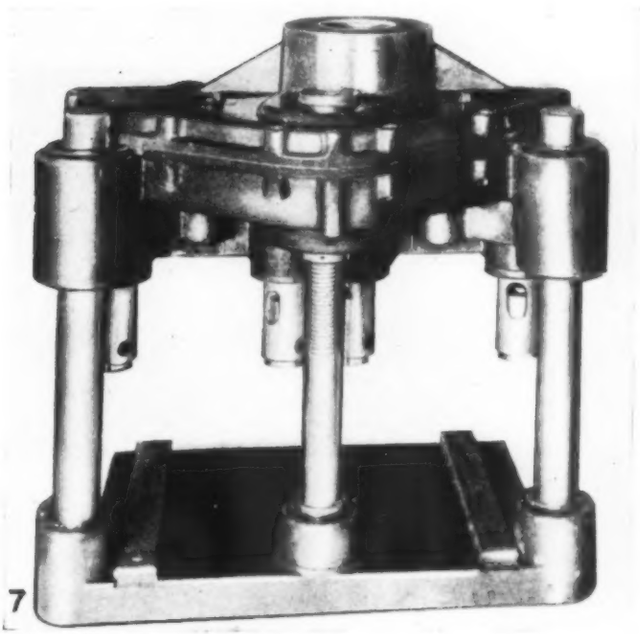


Fig. 7—Drilling and reaming two shock absorber arms at one setting. Bushing plate guided in fixture by hardened pins and bushings

IDEAS · FROM · PRACTICAL · MEN

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit.

Changing Design to Facilitate Manufacture

By Tom Addison

CHANGES in design frequently not only produce a better machine, but also enable the machine to be built at a lower cost. A large boring mill base is a good example of such redesigning.

The design of the original base was in the form shown in Fig. 1 and was a one-piece casting. The width *W* Fig. 2 could be planed satisfactorily in the plant of the manufacturer, but the radius *R* demanded a swing beyond the reach of any boring mill in the shop. As originally designed the base contained the tapered hole which received the table spindle upper bearing. This had to be bored, and the upper and lower ends faced. The bearing surface, or track that supports the table of the machine, was another operation that necessitated swinging the base. Due to this lack of equipment the casting had to have these turning or boring operations finished in another shop, and a man was generally sent to inspect the finished work. All in all this proved an expensive operation as it involved delay and double shipment, extra inspection, and an especially accurate set-up for planing, as the planing set-up had to be obtained from the finished boring and facing operations.

To overcome this difficulty it was finally decided to

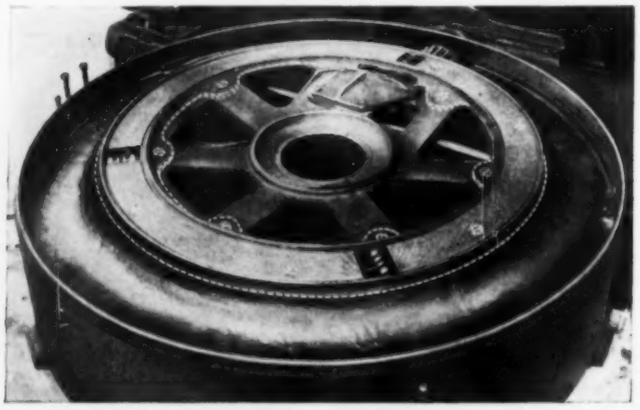


Fig. 1 — The original boring mill base with change shown in dotted lines

make the base in two parts, the division being shown by the dotted lines in Fig. 1. The original outline was retained for the main casting, enabling all previous attachments to be used as before. The track however, was made in a separate casting, coarse, circular in form, and retained the necessary features of lubrication. It was of such size as to be readily machined in the home shop and was later dowelled and bolted to the main casting.

The pad by which this track was fitted to the main casting had sufficient clearance all around so that it could

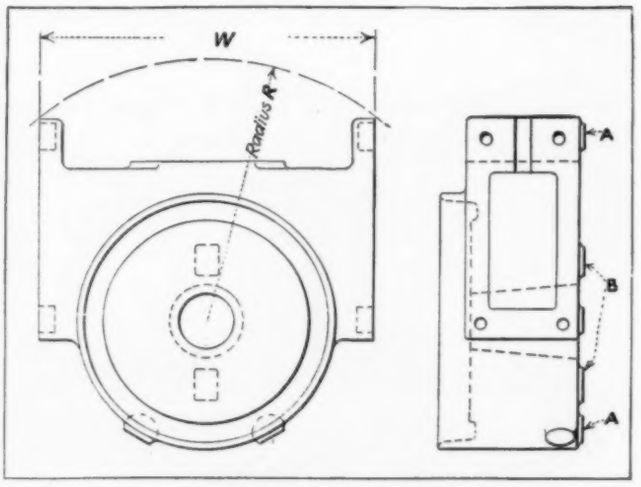


Fig. 2 — Outline of the boring mill base that was redesigned

be planed readily. This made it possible to complete the planing first and do the boring later. Pads *A*, added to the bottom of the main casting, were suitably located on the same plane as pads *B*, which received the brace for the lower spindle bearing. These pads, *A* and *B*, as well as the side walls, were planed on the original set-up and then utilized for squaring up for the remaining planing and boring operations.

A boring bar mounted in the spindle of a radial drill produced the necessary tapered hole, and hence all operations could be done in the plant. This method produced a more accurately finished machine and at the same time reduced the time and the cost appreciably.

Application of Abrasive Disks to Small Disk Grinders

By C. H. Hays

We have a small combination band and disk grinder that proved to be a band grinder only, until we adopted the method described of applying the abrasive disks. The construction of the machine was such that when a disk was cemented on it, the whole machine was useless until the cement had set, the reason being that the driving pulley and the metal disk are in one piece.

The disk part of the machine was made as flexible as the band part in the following manner: We made twelve aluminum disks of the same diameter as that of the metal disk on the machine. Each of the aluminum disks had three holes drilled equidistantly on a circle of 3-in. radius, the holes being countersunk for small, flat-head screws. The disk on the machine was drilled and tapped so that the holes matched those on the aluminum disks. The abrasive disks were cemented to the aluminum ones and after the cement had set, the abrasive that covered

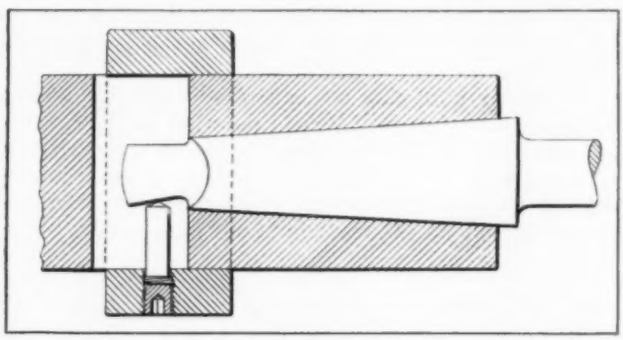
the holes was removed. One of these disks was then attached to the grinder by the three small screws.

By this method it is just as simple to apply abrasive disks to the grinder as it is to apply abrasive bands. The change can be made as quickly as the three screws can be removed and replaced. These "ready to attach" disks are stocked in the toolcrib the same as the abrasive bands.

A Back Counterbore
Discussion

By James G. Gurton

In an article under the title given above by H. G. Mack, on page 215, Vol. 70, of the *American Machinist*, the author refers to the difficulty, ever present in back-facing tools, of retaining them in the spindle while in operation, and suggests the use of a draw-in rod. Such a



Method of holding taper-shank tools

rod would require a special shank for the tool. To depend on friction for retaining the tool in the spindle is a handicap to both the operator and the tool.

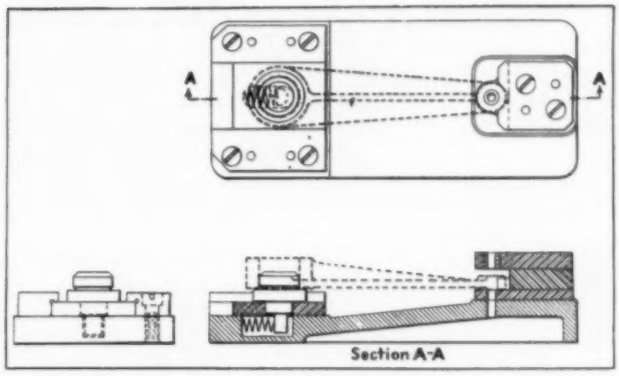
The illustration shows a simple method for holding a back counterbore in the spindle without the use of a draw-in rod. The tang of the tool shank is shaped as shown, and is held in place by a safety setscrew threaded in a collar fitted to the spindle. The collar is necessary, as the screw must pass through the drift slot in the spindle, endwise. It will be noted that the screw not only holds the tool shank in the spindle, but tends to draw it tight in the taper hole.

Drill Jig for Lever Arms

By Hubert M. Taylor

The jig shown in the illustration was designed for drilling the hole in the small end of the piece indicated by heavy dotted lines. While the center distance between the holes in the large and small ends is not important, it is important that the hole in the small end should be in the center of the boss. As some of the parts were cast iron, while others were steel castings, there was considerable variation in their length, due to the difference in shrinkage of the two metals.

The piece is located from the hole in the large end, which was previously drilled and reamed. The locating plug is attached to a spring-actuated slide, which is pulled back when locating the piece on the plug. The spring carries the slide, together with the plug and the piece toward the opposite end of the jig, locating the boss at



Jig for drilling through the center of a boss

the small end in the V-block at that point. Above the V-block is a plate carrying a bushing. With the bushing properly located in relation to the V-block, a drill guided by the bushing will pass through the center of the boss.

Forming Repulsion Irons

By Charles H. Willey

Asst. Plant Supt., Hoyt Electrical Works

The bending fixture we use for forming the repulsion irons for one of our volt and ampere meters, as shown in the illustration, is a rather unique device for making a right-angle bend and at the same time forming a part of a circle. A blank and a finished part are shown at *A*, side by side.

The blank is placed vertically in a groove, or slot, in the lever *B* when it is in the position shown in Fig. 1.

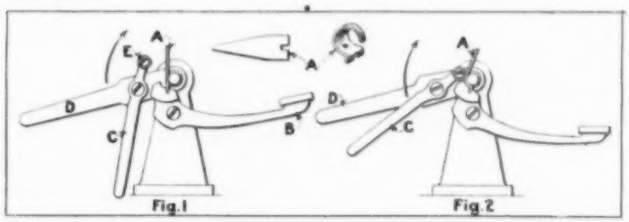


Fig. 1 — Bending and forming tool open to receive the work. Fig. 2 — The tool in the act of forming the circular bend

The lever is then pushed down and the blank is bent at a right angle and the circular part is partially formed against the stationary arbor, as indicated in Fig. 2. Next, the two levers *C* and *D* are squeezed together and are rotated about the arbor in the direction indicated by the arrow. The roll *E* thus forms the rest of the circular part to the shape shown at the right at *A*. The material used is dead-soft Apollo iron, 0.008 in. in thickness. Production by a girl operator is at the rate of 700 per hour at a piece rate of 7 cents per 100 pieces.

Protecting Shop Aisles—*Discussion*

By Matthew Harris

In an article under the title given above, on page 368, Vol. 70, of the *American Machinist*, H. L. Bradford states that the angle irons were screwed to the shop floor, and that pipes were attached to them by means of U-bolts. What he neglected to say is *how* the angle

irons were prepared for screwing them to the floor. Were the ends bent so as to lie flat on the floor?

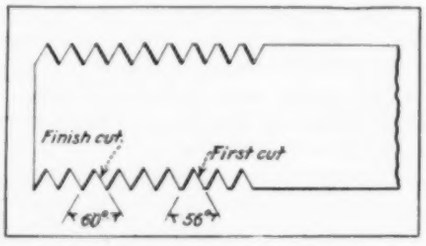
The illustration accompanying the article does not give any inkling of the method of fastening, neither does it show any pipes connected to the angle irons. It does, however, give the impression that the guards are made entirely of angles, or of some other shapes of structural material, stood up on end but with no means of securing them to anything.

Had Mr. Bradford included a sketch showing the method of fastening the angle irons to the floor and the pipes to the angle irons, giving all dimensions, he might have convinced me that his guards had some stability. As they look in the illustration, they are standing up merely from force of habit.

Cutting Smooth Gage Threads

By Charles Kugler

Many firms make soft-steel plug thread gages for temporary use. The threads of these gages must be machined accurately since they are not lapped or ground afterward. The three-wire method of measuring is used, and smooth threads are expected. Many toolmakers use a 60 deg. tool for both roughing and finishing, which seems wrong, for should the tool dig in, as it often does, the thread shows a tear that the finish cut cannot remove because of insufficient metal.



Using different angle tools to cut a smooth thread

I use a roughing tool of approximately 56 deg., cutting to the full depth of the thread, and then take a 60-deg. tool for finishing. The finishing tool cuts only on the sides, and since it is not so likely to chatter, keeps the point sharp clear down to the root diameter. Using this method I can cut clean accurate threads, and there is not so much danger of the threads tearing.

Preventing the Breakage of Small Taps

By Charles Doescher

A most common and at the same time a most aggravating occurrence that occasionally happens to a workman, is to have a small tap break off while he is tapping a hole. There are times when a broken tap will stick so tight that it can not be budged one way or another, in spite of the use of every known trick and tap-removing device. As a last resort, if the broken tap is to be removed, it must be annealed and drilled out. There are a number of things that can be done to help prevent the breakage of small taps, some of which are as follows:

1. Be sure to use the right size of tap drill. Using a tap drill that is too small not only makes more work for the tap, but also causes the tap to bind, which is often the cause of breakage.

2. Be sure to let the starting, or first, tap do all the work it possibly can. Do not let the second or third taps do more than their fair share of the work.

3. It often pays to drill tap holes all the way through the work, providing, of course, that the work is not too thick, or that the through holes will not weaken it, for by drilling the holes all the way through, the tap will be prevented from bottoming. Right here let it be said that bringing the tap to the bottom of the hole with too strong a turn of the tap wrench is one of the more common causes of breakage. Therefore, it often pays in cases where the holes cannot be drilled all the way through, to drill them a little deeper than is necessary, in order to prevent the tap from bottoming.

4. In cases where the holes must be tapped to the bottom, be sure to clean out the chips from the bottom of the hole, for if the chips are not cleaned out they will "mat" on the bottom and will not allow the tap to cut to the full depth of the hole.

5. In tapping a hole with a small tap, do not force the tap nor use too long a tap wrench.

6. It is good practice to feel your way, keeping your mind concentrated upon what you are doing. Then if the tap works hard or comes in contact with the bottom of the hole, your sense of feeling will warn you of the danger of breaking the tap, and you can be governed accordingly.

In conclusion, it may not be amiss to add that when a tap is broken off in the hole and the work must be heated to anneal the tap, the best thing to do, in case there are other holes to be tapped, is to tap them all before doing the annealing, so that in case another tap is broken, one annealing will do the trick for both broken taps.

Chart Board for the Storeroom

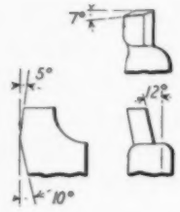
By Morton Schwam

A very convenient method of keeping a record of stock in the storeroom may be accomplished by a chart board. The one shown in the illustration is for keeping track of steel tubing. The board is painted black, while the lettering is in white. The sizes of the tubing are in a vertical column at the left, while the thicknesses by gage numbers are read horizontally. The various sizes of tubing ordinarily carried in stock are each marked by a circle in the center of which is a hole drilled through the board. When the supply of any particular size is exhausted, a pin, painted red, is placed in the hole to indicate that such is the case, thus eliminating the time that would be otherwise required to make an investigation. Such a chart board can be made for rods, sheet stock, bolts, and similar items.

Steel Tubing in Store-Spec 1025							
Outside Diameter	Wall Thickness in B.W.G						
	No.22 (0.028)	No.20 (0.035)	No.18 (0.049)	No.16 (0.065)	No.15 (0.072)	No.14 (0.083)	No.11 (0.120)
½	◎		◉			◎	
⅝	◎	◎		◎	◉		
¾	◉	◎	◎	◎		◉	◎
⅞		◎	◎		◉	◎	
1	◎		◉	◎	◎		◎
1¼		◎		◎		◎	◎
1½			◉	◎	◉		◎
1¾		◎		◉	◎	◎	◉
2				◎		◉	◎
◎ Indicates stock sizes on hand							
Pin in hole indicates sizes exhausted							

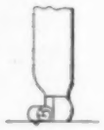
Chart board for keeping track of supplies

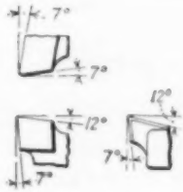
Grinding Chart for Tools



Planer Finishing Tool

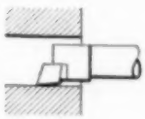
A shear tool
Spiral action of cutting edge causes chip to be sheared off in a fine thin ribbon.
Used on planers and shapers.

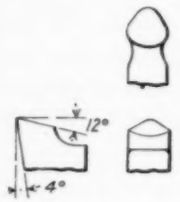




Inside Boring Tool for Cast Iron

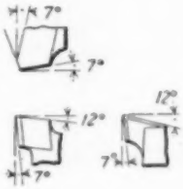
For general boring operations on cast iron.





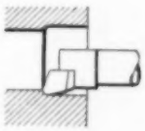
Straight Round Nose Tool

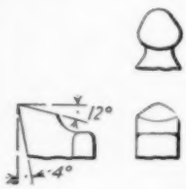
The most popular of tools.
Applicable to any operation.
In the smaller sizes, the round appears diamond shaped.



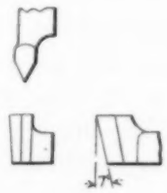
Inside Boring Tool for Steel

Same as for above except entering cutting edge is relieved 15° to prevent steel chips from clogging hole.



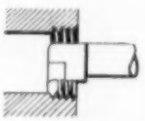


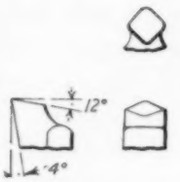
Offset Round Nose Tool



Inside Thread Tool

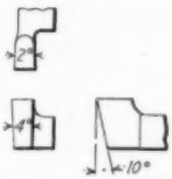
For internal thread cutting. Grind on top only.





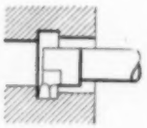
Diamond Point Tool

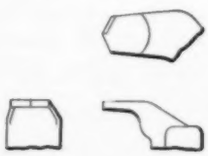
A diamond point tool for planing.
Handy for machining into a corner.



Inside Square Nose Tool

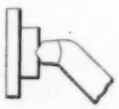
For recessing into sharp corners. Also for finishing if tool is set square with surface.

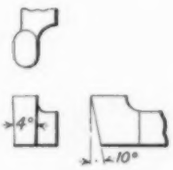




Spotting Tool

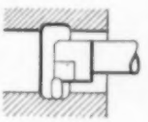
Shown with 120° angle used for spotting for drilling.
Also ground with 60° angle for spotting and truing centers.

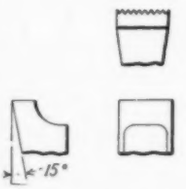




Inside Round Nose Tool

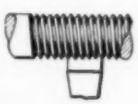
For recessing or boring into a round corner.

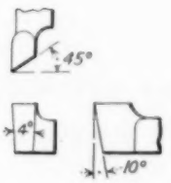




Thread Chasing Tool

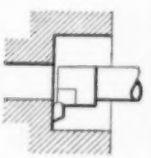
For thread finishing.
Grind on top of tool only.

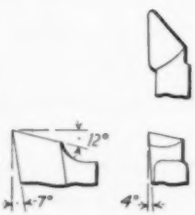




Inside Facing Tool

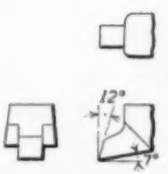
For internal facing operations and finishing face into a corner.





Dovetail Tool

Long beaklike projection permits tool to machine dovetail slides.



Keyseating Tool

For cutting keyways and accurate slots.
Particularly used on shaper, planer or slotter.
Grind on top of tool only.

Courtesy of The O. K. Tool Company, Incorporated

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American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

A Penalty of Prosperity

NOW that real prosperity has at last overtaken the builders of production equipment we are beginning to hear two laments, both coming from the same difficulty—a shortage of skilled men. One complaint is that not enough apprentices are being trained to fill the gaps that inevitably show up when business becomes active. The other is that the automobile manufacturers are hiring good men away from the equipment builders by offering them higher wages.

The first lament is entirely justified. Most of the equipment builders have been training some apprentices, although perhaps not as many as they should. Their customers, on the other hand, have not been training their share of beginners, and are now sponging on the equipment builders. Obviously, it is too late to do anything about it now, but the campaign to educate these shirkers to their responsibilities in the training of workers should be pursued relentlessly.

But the responsibility for the other complaint lies elsewhere. There is no real economic reason why any equipment builder should not charge enough for his product to permit him to pay wages at least as high as those offered by his customers. He certainly needs the men of the highest skill and now, if ever, he should be making enough to hold such men. If he is not, there is something wrong with his price figuring and he should look into it at once.

The Best Defense Against Communists

THE disastrous fire that is reported to have ruined the new German liner Europa is being laid to communistic revenge for failure to win the shipyard strike of last year. And organized communism is also being blamed for the textile strike in New Jersey some months ago. In commenting on this strike one observer explains in some detail how a very small group of professional agitators insinuated themselves into the various departments, selected the most pressing grievances of the employees, and harped on them until they managed to precipitate a strike involving thousands.

In his comments on the textile strike the same observer calls attention to the key position of the foreman when such a situation is brewing. He believes that the foreman should be able to ferret out the trouble makers and get rid of them before they have done too much harm.

There is no question, of course, but that the foreman is an extremely important factor in a plant where unrest is current, but he should not be expected to attempt the cure of such a situation by getting rid of the agitators alone. He should be urged to find the real reason for the discontent, and his efforts should be backed by the most hearty co-operation of the higher executives. If this reason can be eliminated the agitator has a much harder job to drive the average worker to the point of revolt. In fact, his chances of bringing about a strike in a plant where the working conditions are good, and the workers are satisfied that they are getting a square deal, are exceedingly remote.

Many Aviation Engines Need Further Development

THE demand for aviation engines of moderate power has led many designers into the 100—150-hp. field. Some of them apparently have failed to realize the difference in the requirements between airplane and automobile service, for only a comparatively few of the engines pass the tests conducted by the Bureau of Standards for the Department of Commerce.

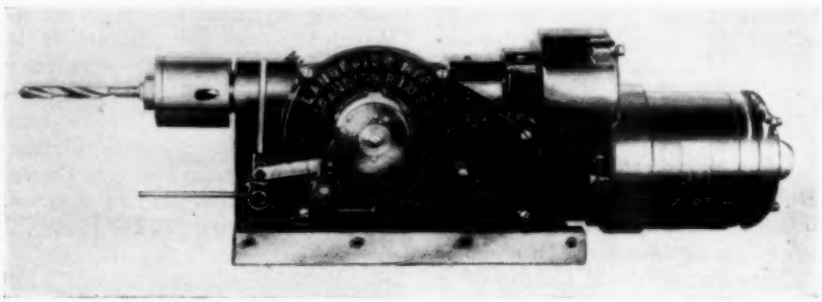
A recent report shows that out of twenty-one engines so tested but six were successful in receiving the certificates approving the engines for use in aircraft. That the average manufacturer should do more development work before going into production, seems evident. Airplane engines need tests under actual service conditions. Laboratory tests can hardly simulate the rapid changes in temperature found in flying, nor the effect of rain, snow or dust storms on an engine in service in a plane.

The necessity of keeping out of the air engines that do not pass rigid tests can hardly be overemphasized. Good engines are almost as necessary to protect the people on the ground as the aviators themselves.

There is a growing field for reliable engines for airplane use and a lucrative business awaits those who can meet the demand. But no one should enter the field without a full realization of the responsibilities involved.

Langelier Improved Automatic Drilling Units

IMPROVEMENTS in construction, operation and adaptability are embodied in the recently redesigned line of automatic drilling units made in three sizes by the Langelier Manufacturing Company, Arlington, Providence, R. I. The original units were described on page 1111, Vol. 66, of the *American Machinist*. One of the chief improvements is positive cam travel, accomplished by the substitution of a face cam instead of the radial cam used in the earlier models. Other features are total inclosure of the moving parts, simpler construction, in that fewer parts are used, and the use of ball or roller bearings wherever possible.



Langelier Improved Automatic Drilling Unit with built-in motor drive

These units being self-contained as to feed and speed can be arranged around an indexing dial to produce successive operations on a piece, such as drilling, reaming, facing, counterboring and tapping in one setting of the work. The units can be used in gangs, horizontally or vertically, side by side, or in a horizontal duplex machine. They can also be used at any angle.

Three sizes are made: The No. 11 size has a drill capacity of $\frac{1}{4}$ in. in steel and a maximum spindle speed of 8,000 r.p.m. The No. 21 size has a drill capacity of $\frac{1}{2}$ in. in steel and a maximum spindle speed of 6,000 r.p.m., while the No. 31 size has a drill capacity of $\frac{3}{4}$ in. in steel and a maximum spindle speed of 4,000 r.p.m. The cam provides a total travel of 3 in. in all cases.

The units are sturdily built and all working parts are totally inclosed, excepting the clutch. The cam and wormwheel shafts run on roller bearings at their outer ends, and are hardened and ground. The wormwheel itself is made of phosphor-bronze, and has a two-to-one speed reducing differential. It operates in oil. Change gears having ratios from 1 to 1 and 4 to 1 are used to vary the number of cam cycles. These change gears are made of carbon steel, pack hardened, while the cam, roll and pin are made of hardened tool steel.

The cams are specially cut for each job to give rapid approach, drilling feed, and rapid return. The camshaft projects out of the head on the left side to permit, if required, the mounting of a cam to operate an indexing fixture or to control the automatic tripping of the clutch.

As shown in the illustration, the driving motor is built directly into the unit and it is possible to vary the spindle speed by means of change gears. The drilling spindle itself is driven by a double keyed and splined hardened worm sleeve mounted on ball bearings at the rear of the head, this sleeve being geared to the motor by the change gears mentioned. These gears are totally inclosed in the motor housing attached to the head.

The spindle proper runs in phosphor-bronze bushings on the feed sleeve, and a deep-groove radial ball bearing is used at the end of the spindle. The mounting is such that backlash is eliminated in the feed spindle, thus insuring the facing or counterboring to close limits.

Multiple-spindle drilling heads can be clamped to the head of the feed sleeve when required. Reversible tapping attachments can also be used with special feed cams. Where motor drive is not desirable belt drive can be used. The maximum powers required for the maximum capacity of the heads is 1 hp. for the No. 11 size, $1\frac{1}{2}$ hp. for the No. 21 size, and 2 hp. for the No. 31 size. The weights of the three units are 250, 325 and 400 lb., respectively.

Olsen-Lewis Strain-Gage Extensometer

Determination of the stresses in machines as well as in test specimens can be made by means of the Olsen-Lewis strain-gage extensometer placed on the market by the Tinius Olsen Testing Machine Company, 500 North 12th St., Philadelphia, Pa. The instrument can be used in the usual way as an extensometer on the standard 0.505-in. test specimen, using a 2-in. gage length. The lever combination is so located with reference to the dial and gaged length that the instrument gives accurate indications regardless of the operating position. Inertia reactions have a minimum distorting effect on the dial readings, thus assuring accurate readings. This instrument is used where it is necessary to secure knowledge of suddenly applied or intermittent loads on support members. For example, the device may be set up on the frame of a punch press.

Olsen-Lewis Strain-Gage Extensometer

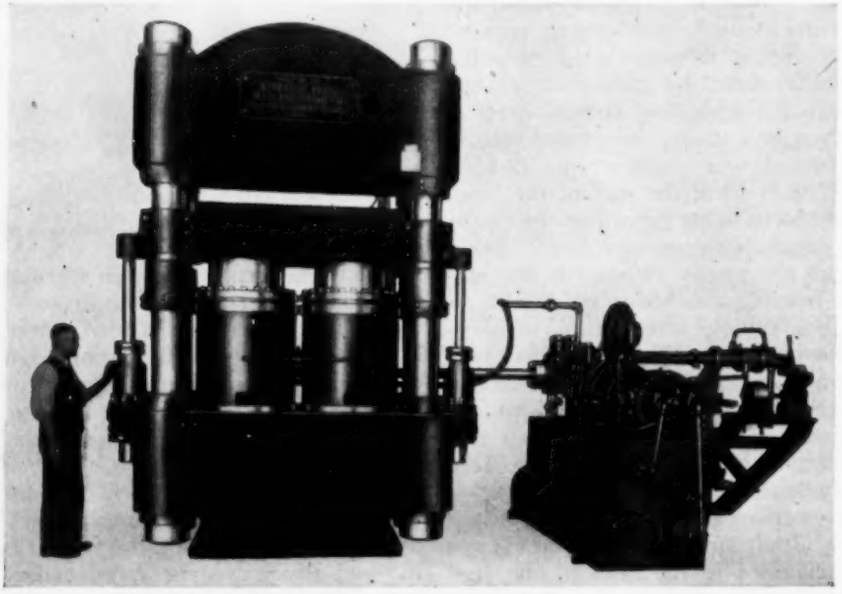
When the instrument is set up with the pins in punch marks, each mark on the dial indicates 0.000066 in., and when used in $\frac{1}{16}$-in. drilled holes, each mark indicates 0.00006 in. The instrument is supplied with a convenient carrying case.

"H-P-M" 1,000-Ton Hydraulic Embossing Press

AUTOMATIC controls regulate the operation of the 1,000-ton hydraulic embossing press built recently by the Hydraulic Press Manufacturing Company, 20 East Broad St., Columbus, Ohio. These controls are embodied in the two-stage generator shown at the right of the illustration. They cause the platen to move up at the rapid rate and then shift to the slower pressing speed. The pressure is next built up to a predetermined maximum, which is held for a definite time limit, after which the pressure is released and the platen reversed at the rapid rate to the open position, when the cycle is reversed and repeated. Although the press will give a maximum pressure of 1,000 tons, twelve 1-in. strokes per min. can be obtained. The platens are 58x28 in. and a maximum stroke of 8 in. may be had.

The press is double-acting, the working pressure being applied on the upward stroke. After embossing has taken place, two auxiliary pressure cylinders return the ram rapidly to its lower position. No control valves are installed on the press. By means of the control valves on the generator, the following may be obtained: Automatic pressure regulation, adjustable working pressure, variable stroke, adjustable opening, variable timing of the operating cycle, and close speed regulation.

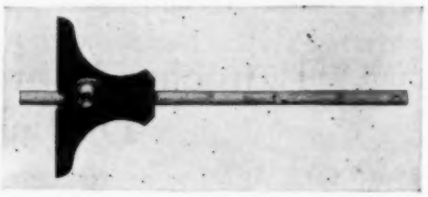
Presses having capacities ranging from 250 to 2,000 tons or more can be built in this model. The size of the power generator unit will be governed, not only by the total pressure capacity of the press, but also by the speed in stroke inches per min. and portion of each stroke that is operated under full pressure. Because it is possible to apply various degrees of pressure to various portions of the stroke, and also because the length of stroke can be regulated to accommodate different classes of work, it is readily apparent that the method of operation of the press is extremely flexible.



"H-P-M" 1,000-Ton Hydraulic Embossing Press with Two-Stage Generator Unit

Brown & Sharpe No. 616 Rule Depth Gage

Rule depth gage No. 616, recently announced by the Brown & Sharpe Manufacturing Company, Providence, R. I., has the additional feature of an easily adjusted protractor. The blade of the gage may be locked easily at any angle in relation to the head by the larger of the two clamp nuts on the front side of the head. The turret



Brown & Sharpe No. 616 Rule Depth Gage

is graduated in 10-deg. units, from 0 to 90 deg. inclusive. A smaller clamp nut on the front side of the head locks the blade for use as a depth gage. The 6-in. blade is graduated in 32nds and 64ths, or in millimeters and half-millimeters.

"Wonder KodeKall" Signalling Device

Thirty different persons or stations can be called by means of the "Wonder KodeKall" announced by the Schwarze Electric Company, Adrian, Mich. The device is simple to install and to operate. The telephone operator sets a little dial at the combination number for the man desired and the plunger is pushed down as far as it will go. The KodeKall

"Wonder KodeKall" which will call thirty different stations

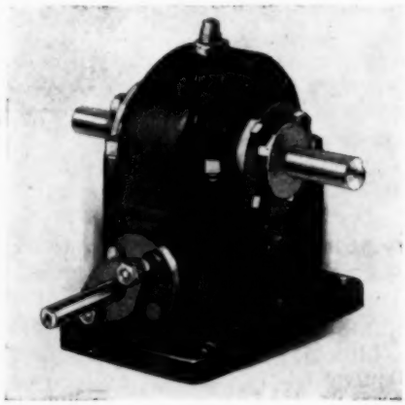
operates, causing the correct buzzers, bells or horns to sound three times in succession.

To operate the KodeKall all that is necessary to do is to pull forward the outside knob and set the indicator on the first digit of the code number wanted. The dial is then allowed to slip into place and the inside knob is pulled forward, the second indicator being turned to the second digit of the number that is required. This knob is then allowed to slip back into place and the plunger depressed, the call then being given at the station desired. The device is neatly fin-

ished throughout and occupies less than 6 in. of space. It can be used on systems consuming up to 500 watts, when used with a relay on either a.c. or d.c. current, or without a relay when the consumption is below 100 watts.

Ohio Wormgear Speed Reducers

A series of small wormgear speed reducers has been developed by the Ohio Gear Company, 1333 East 179th St., Cleveland, Ohio. These reducers



Ohio Wormgear Speed Reducer

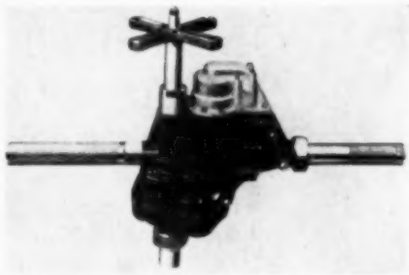
are built in four sizes, Nos. 0, 1, 2, and 3, the largest of which is rated at 2 hp. They are equipped throughout with Timken roller bearings, which permit operation at high speed. The worms are hardened and have their threads ground. They work with phosphor-bronze wormwheels. Practically any ratio between 6 to 1 and 100 to 1 can be obtained for all sizes manufactured.

Rotor No. E-5 Pneumatic Drills

Both reversible and non-reversible pneumatic drills, known as the No. E-5, have been placed on the market by the Rotor Air Tool Company, 5905 Carnegie Ave., Cleveland, Ohio. This drill weighs only 22 lb., is compact, and well-balanced, and it is claimed that a man using it can do the work formerly done by two men, because of its convenient operation and sturdy construction. The drill is suitable for heavy-duty $\frac{29}{32}$ and $1\frac{1}{4}$ in. drilling, $1\frac{1}{8}$ and $1\frac{5}{16}$ in. reaming, setting $\frac{3}{4}$-in. S.A.E. nuts, and, in the reversible type tapping of $\frac{5}{8}$-, $\frac{3}{4}$-, and $\frac{7}{8}$-in. holes.

By removing the dead end handle, the drill may be used for many types of close-quarter drilling. The unit may be supplied with a feed screw as shown or with a spade handle. The rotor motor has only three moving parts, which transmit power through heat-treated compound gears, three speeds being provided, which are 220, 280, and 350 r.p.m. The governor automatically prevents racing at idling speeds and reduces air consumption to a minimum. The action of the rotor governor maintains the spindle speeds at the correct working speeds for different applications, thus preventing undue wear on the tools.

Positive lubrication is provided by

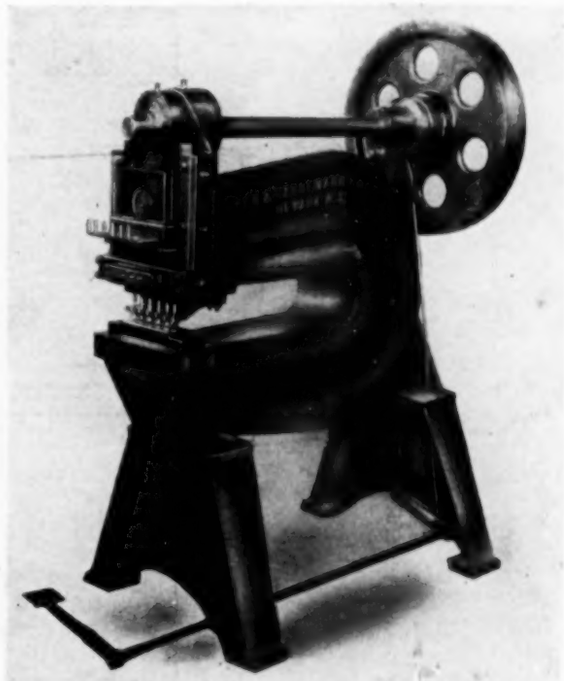


Rotor No. E-5 Pneumatic Drill

means of an oil reservoir in the body. The feed screw is of the heavy-duty type with $3\frac{1}{2}$ in. of travel. Special attachments for nut setting and stud driving can be furnished. Additional speeds ranging from 220 to 600 r.p.m. can be furnished.

Zeh & Hahnemann No. 4-4B Selective-Die Punch Press and Nibbler

INDIVIDUAL action of the six punches and dies on the No. 4-4B punch press and nibbler can be brought about by pressing the corresponding buttons. The standard punches and dies furnished are $\frac{3}{4}$, $\frac{5}{8}$, $\frac{1}{2}$, $\frac{3}{8}$, and $\frac{1}{4}$ in. in diam. A nibbling punch and die are also furnished, and the latter can be quickly inserted. Cutting speed of this device is 36 in. per min. The machine has been placed on the market by the Zeh & Hahnemann Company, 182 Vanderpool St., Newark, N. J. It permits cutting shapes and openings of any form, as well as punching holes. The punch is pedal controlled and stops automatically at the high point of the stroke. The throat is 24 in. deep, enabling holes to be punched in the center of 48-in. sheets. The strippers are arranged to allow the use of the horseshoe system of gaging. A master templet with suitable gaging points is clamped to the sheet or pack of sheets to be punched, and all holes can then be punched in accurate position without any marking. Maximum capacity of the machine is a $\frac{3}{4}$-in. hole through $\frac{3}{16}$-in. sheet steel. The size of the driving wheel is 26x4 in., and the speed is 120 r.p.m. The machine can be furnished with a direct-connected 1-hp. motor, if desired. The weight is 2,500 lb. net.



Zeh & Hahnemann No. 4-4B Selective-Die Punch Press and Nibbler

Oster No. 602 Bar and Pipe Cutting-Off Machine

BAR stock from $\frac{3}{8}$ to 2 in. and pipe or tubing from $\frac{1}{4}$ to $1\frac{1}{2}$ in. may be cut off by this revolving-head, blade-type, cutting-off machine announced by the Oster Manufacturing Company, Cleveland, Ohio. Advantages claimed for the revolving-head type of machine are: Minimum weight, power, and floor space, and no whipping of stock that is not straight. The machine is powered with a universal motor operating on 110-volt, single-phase circuits from 25 to 60 cycles, or 110 volts d.c. The chief reason for the selection of this type of motor was that its speed is governed by the load put on the machine, and therefore the cutting speed is reduced as the distance of the cutters from center increases. This tends to give the cutting tools a constant peripheral speed throughout the cut. The return of the blades for the next cut is at the highest speed of which the machine is capable. The motor is provided with a start and stop trigger switch, into which is built a circuit breaker, thus protecting the motor from overload.

The drive is from the motor through a silent chain to a jackshaft mounted in Timken roller bearings. The jackshaft carries the speed clutches and drives the spindle, which is also mounted, both front and rear, in Timken roller bearings. The cutter head is provided with two cut-off blades mounted opposite each other in adjustable gibs in the head. These slides are operated radially by a scroll cam mounted on the head and driven by the jackshaft. The speed of the slides in and out is obtained by a differential action of the scroll relative to the cutter head. The cutting tools are gibbed into the slides. The cut is first taken by a tool, which has a nose like a U.S.S. thread, and which has one-half of its V in advance of the flat tool, thus splitting the cut into three chips and assuring long life of the blades. The mounting of the tools in the slides is inclined from the radial to give the proper rake, thus requiring only end grinding of the parting tools. Setting of the blades relative to the center of the bore is accomplished by the use of a simple gage locating from the rear of the slides.

The machine is provided with a universal, direct, lever-operated scroll chuck of simple and rigid design, utilizing two sets of three serrated jaws, each set operated by a double-sided scroll, the jaws being so spaced as to give ample holding power. The direct lever-operated feature of the chuck provides for release or gripping by the movement of the chuck lever through an arc of not over 30 degrees, thus permitting fast operation.

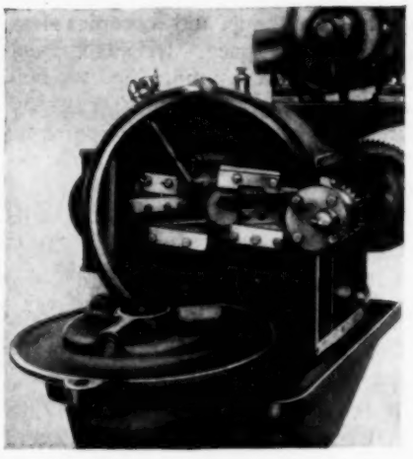


Fig. 3 — Close-up showing the slides and cutting tools

Simple operation of this cutting-off machine is the principal feature. Stopping of the blade at the proper limit of travel for both the inside and outside diameters is accomplished by two dogs or stop collars. After the size of stock to be cut is determined, the O.D. collar is quickly set to a graduated scale mounted on the machine, and the I.D. collar is set to zero in the case of soild stock, or to the proper I.D. size in the case of tubing. These settings may be obtained rapidly, thus making the machine suitable for small runs or even single cuts, as well as for long production runs. The stock is inserted in the chuck and is run through to the proper position either by measurement or with the use of the stop illustrated in Fig. 1, and the chuck tightened. The motor is then started and the clutch lever engaged. From this point on the operation of the machine is entirely automatic, as the blade will be fed in at the rate of 0.006 in. per rev. until the piece is cut off. It will then be returned to the open position at five times the rate of in-feed, so as to be ready for the next cut on the same size of stock. Further operation of the machine on the same stock consists only of opening the chuck, pushing the stock through to the proper position, tightening the chuck, and en-

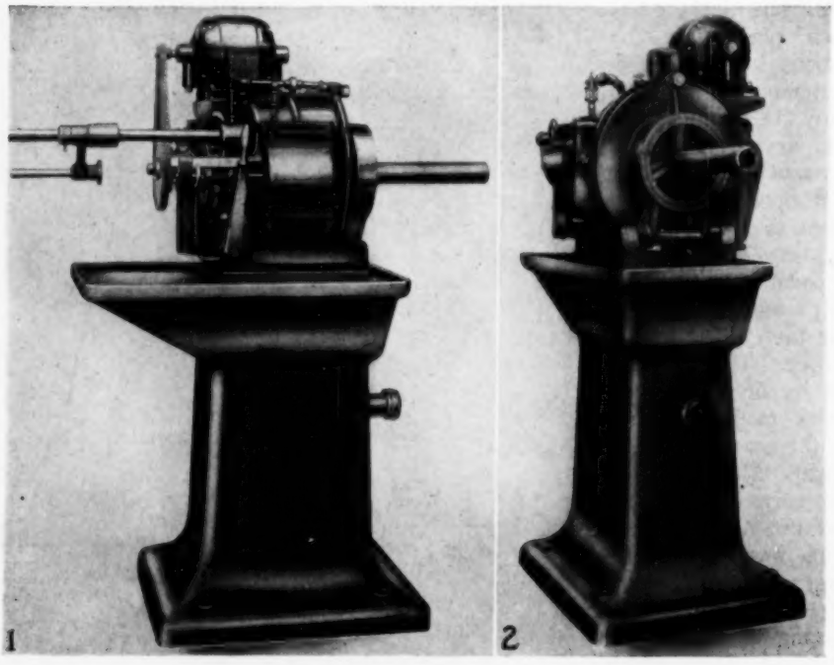


Fig. 1 — Oster No. 602 Bar Stock and Pipe Cutting-off Machine. Fig. 2 — View from the cutting end with the revolving head cover in place

gaging the clutch lever. The motor is run continuously during the operation of the machine, except when changing the setting of the stop collars. Except on tubing, one operator can handle two or more machines, depending upon the diameter of the stock to be cut off. The machine carries all of the necessary accessories such as cutting compound pump, reservoir, chip strainer, and a guard.

Ingersoll-Rand Multi-Vane Pneumatic Grinder

Smooth running because of the multi-vane construction is a feature of the multi-vane grinder, which has been placed on the market by the Ingersoll-Rand Company, 11 Broadway, New York, N. Y. It is claimed that this machine is the lightest portable grinder made in its capacity, and that it is also the quietest. Because of these qualities, it enables the operator to produce more work with less fatigue.

The speed governor permits the grinding wheel to be operated at its maximum safe speed when heavy cutting is encountered. By means of this governor, the speed can be adjusted to any amount up to 6,300 r.p.m. Therefore, grinding wheels of different diameters can be driven at their best cutting speeds. Standard machines are set at 4,200 r.p.m., which is the best rate for 6-in. vitrified and 8-in. elastic-bonded wheels.

Ingersoll-Rand Multi-Vane-Rotor Grinder

Four power vanes are used on the rotor, which is made of steel, hardened and ground, and which has a full-floating fit on its arbor. This construction permits the rotor to align itself between the two end plates. An exhaust deflector is used, which also serves as a muffler. It baffles the exhaust air passing through it to remove the penetrating noise that is typical of rotary air grinders. By this feature the sound of the exhaust is reduced to a soft purr. In addition, the exhaust deflector can be turned to deflect the exhaust in any desired direction.

The wheel end bearing consists of two radial thrust ball bearings, placed to take the thrust from either direction. Grinding on either side of the grinding wheel therefore will not be detrimental to the life of this bearing. An oil chamber is provided in the handle of the tool. From this chamber the oil is fed automatically into the live air going into the machine every time the grinder is stopped and started. Thus it keeps all wearing parts running in an oil film. The machine can be fitted with various types of grinding wheels and brushes for grinding, buffing, polishing, or cleaning work of various types. Two forms of handles are furnished, a squeeze-type straight handle or an inside-trigger grip handle at the purchaser's option.

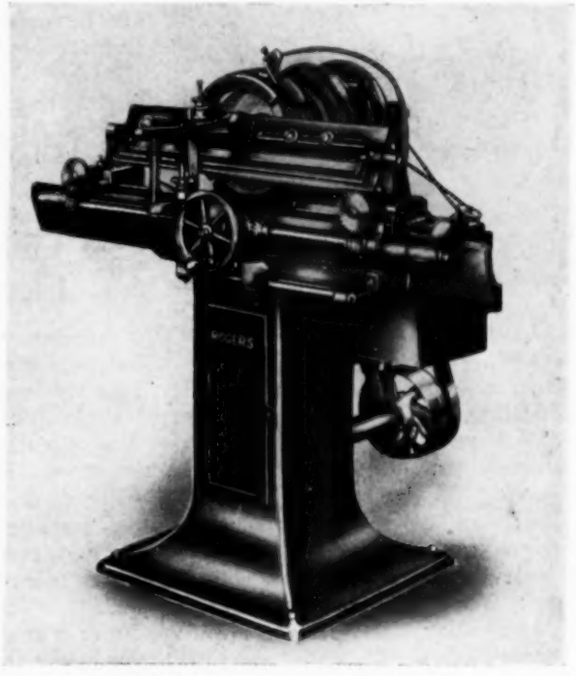
Weldit Styles C and G "Gasavers"—*Correction*

In the announcement on page 337, Vol. 70, of the *American Machinist*, of the Styles C and G "Gasavers," manufactured by the Weldit Acetylene Company, Detroit, Mich., the statements concerning the fuel gases used in each were incorrect in that they were reversed. The Style C Gasaver is placed between the supply tanks and the torch for the purpose of shutting off whatever combination of acetylene, hydrogen, or illuminating gas with oxygen is used, when the torch is hung upon the arm, thus permitting the nozzle adjustment to be maintained. The Style G is used similarly, when illuminating gas and compressed air are used.

Rogers Type W Reversible Knife Grinder

GRINDING of knives either against or away from the cutting edge can be done on the type "W" full-automatic, reversible knife grinder, announced by Samuel C. Rogers & Company, 191 Dutton Ave., Buffalo, N. Y. Grinding against the cutting edge can be done within plain view of the operator and grinding away from the cutting edge can be done by simply reversing the knife bar. The travel of the knife carriage and the cross feeding are entirely automatic, although hand cross feed can be obtained by means of the center handwheel. The worm gears insure even and accurate cross feeding of the knife up to the grinding wheel, with a device for stopping the cross feeding at any point. The machine is built in five sizes to take 26- to 54-in. knives. The 26-in. size is illustrated, the view showing the arrangement of the full automatic cross-feeding device and the 10-in. cup wheel and controls.

The machine stands 3 ft. 6 in. high, on a cored base inclosing the driving and shifting gears. Either straight or concave bevels can be ground and the machine can be operated as fast or slow as desired. An index is provided for gaging the degree of bevel. The machine is claimed to be light running and almost noiseless in op-



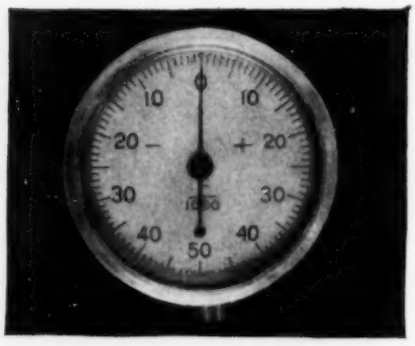
Rogers 26-Inch Type W Motor-Driven Reversible Knife Grinder

eration. It is provided with stops to regulate the distance of travel according to the length of knife being ground. Thin, high-speed knives without slots can be ground by using a special steel gage clamp.

All sizes of the grinder can be furnished with a plain or ball bearing arbor and with built-in motor or belt drive. The tight and loose pulleys are 6 in. in diam. by 2¼-in. face, and should run at 1,100 r.p.m. A water attachment consisting of water tank, pump, pipe hose, and a stop cock for regulating the flow of water at the grinding contact are furnished regularly. As stated previously, five sizes are built, the floor space required, while running, ranging from 5 ft. 6 in. by 2 ft. 6 in. to 10 ft. by 2 ft. 6 in. All sizes require a 1-hp. motor. The weights range from 640 to 1,150 pounds.

Federal Model 80 Jr., Dial Indicator

A range of 0.200 in. is available in the Model 80 Jr., dial indicator announced by the Federal Products Corporation, Providence, R. I. The diameter is 1⅞ in. and the holding bar is 2⅜ in. long by ¼ in. in diam. Special sizes of holding bars can be furnished when desired. The Model



Federal Model 80 Jr. Dial Indicator

80 Jr. is similar in construction to the Model 80, but is smaller in diameter.

With regard to the interior construction, the four main bearings are jeweled, the racks are chromium plated, and the movement is a separate unit, insuring perfect alignment. The stem is fastened integral with the case. The case is die-cast of special bronze alloy, and there are no soldered joints. The entire movement can be removed for cleaning or repairing in less than two minutes.

Pollard Steel Stand for Oil Drums

An all-steel stand for supporting drums on their sides, while emptying the contents, has been placed on the market by the Pollard Brothers Manufacturing Company, 4035 North Tripp Ave., Chicago, Ill. The stand is equipped with rollers as shown, and, therefore, may be shifted from place to place. It is clean and fire-

Pollard Steel Stand for supporting oil drums in use

proof, and is of the correct height so that a 5-gal. pail can be placed under the tap to draw the material. Casters are provided on the upper ends of the legs to carry the drum so that it may be rotated until the tap is in position for pouring. The two end sections are arc-welded and lengthwise angles are riveted, thus making a flat package for shipping. The frame is made of 1½x1½x⅛-in. angles.

Lincoln Type T Electrode Holder

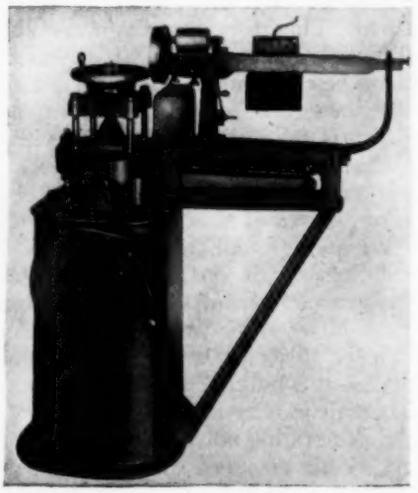
An improved type of electrode holder for metallic arc welding has been announced by the Lincoln Electric Company, Coit Road and Kirby Ave., Cleveland, Ohio. This holder, known as Model T, consists essentially of a powerful clamp to hold the welding electrode firmly while welding, and an easy release feature, which permits changing electrodes quickly. The handle grip is designed for easy holding, and it is claimed that the holder remains cool during operation, because the welding current is carried from the point of the cable entry

Lincoln Type T Electrode Holder

to the copper jaws by means of copper strips of low resistance. Sticking of the electrode to the jaws is reduced by the use of copper tips. The shape of the holding clamp has been altered to give greater compactness so as to permit work in close corners. All metallic parts are coated with cadmium to prevent tarnishing.

Olsen Lever-Weighing Ductility Testing Machine

Measurement of the load during tests can be made on this screw-power, sheet-metal ductility testing machine by means of the lever weighing construction. The tester is manufactured in hand-operated and motor-driven types by the Tinius Olsen Testing Machine Company, 500 North 12th St., Philadelphia, Pa. The machine illustrated is arranged for manual operation, and is equipped with a dial vernier screw beam. When desired, however, it may be obtained with either an automatic beam or automatic and autographic attachment showing graphically the relation between the pressure and the depth of cupping. The mechanism for producing the cup in the sheet metal and the method of operation are



Olsen Hand-Operated, Lever-Weighing Ductility Testing Machine

similar to those employed in the No. 2A machine described on page 532, Vol. 70, of the *American Machinist*. The depth of cup is noted from the dial gage with the specimen in full view of the operator at all times, while fracture is indicated accurately by the drop of the scale beam.

This lever-weighing ductility testing machine is available in five sizes, having capacities of 10,000, 20,000, 30,000, 40,000, and 50,000 lb., respectively. The dimensions range as follows: Length from 4 ft. to 4 ft. 9 in.; width from 2 ft. to 3 ft. 4 in., and height from 3 ft. 4 in. to 3 ft. 9 in. The weights range from 980 to 1,820 pounds.

REVIEW · OF · RECENT · PATENTS

Relating to the Machinery and Metal Products Industries

Metal-Working Machinery

A valve grinding machine was patented, 1,702,267, and assigned to the Miller Service Tool Co. In the machine the stem of the valve is supported at widely separated points, one of which is near the valve end, and the work is rotated by means of a driving head on the carriage.

An automatic machine for making flux-carrying welding rod was assigned, under patent 1,702,304, to the Koro Corporation. Recessing rolls form cavities in the rod into which the flux is fed. The recesses are then closed and the rod is straightened as it advances continuously through the machine.

A nut-forming machine was patented, 1,702,320, and assigned to the Pittsburgh Screw & Bolt Corporation. The nut is punched out and then transferred automatically to a station where it is finished and threaded.

The American Tool Works Company was assigned a patent 1,699,493, covering a means for feeding drilling machines. It comprises a power drive for the drill head, the latter being capable of both rotation and lengthwise movement on the drill arm.

Parts and Mechanisms

A diehead was patented, 1,701,846, by Charles P. Harrison, Wesleyville, Pa. It has a cam plate in the body to move the chasers in and out, the mechanism being operated by means of a lever and plunger.

A toolholder with a sliding blade-tool held in by means of grooves and a screw was patented, 1,701,980 by John M. Luers, of Detroit.

A milling cutter patented, 1,702,132, by Joseph M. Redinger, of Providence, R. I., consists of a double-end end-mill held in a holder having a clutch, which grips the cutter at a cutaway part at the center.

The Morse Chain Co. was assigned a patent, 1,701,820, on a tensioning device for drive chains. It comprises a sprocket wheel on an eccentric, and a means for rotating the wheel to take up the slack to maintain a constant tension.

A safety device for punch presses was patented, 1,701,822, and assigned to the American Can Co. In the device a shaft, which controls the starting, runs across the front of the press. The operator is required to grasp handles on each side of the shaft in order to start the press.

A friction clutch patent, 1,703,101, was assigned to the Barber-Colman Co. In the clutch the movement of an arm pivoted to the movable pressure member causes frictional engagement with the friction disks attached to the pulley.

A lathe chuck patented, 1,703,200, by John S. McWhirter, Southport, Conn., has a hollow body to receive the work, and a sliding wedge operated by a screw and nut at the side.

A compressor for a lubricating system was patented, 1,703,278, and assigned to the Alemite Manufacturing Corporation. It comprises both low- and high-pressure compressing cylinders in a body, the former discharging the lubricant into the latter. Four other patents, 1,703,281, 1,703,285, 1,703,286 and 1,703,304, on lubricant compressors for the pressure forcing of lubricants into bearings were assigned to the same company.

Two types of paint spray guns were patented, 1,703,383, and 1,703,384, and assigned to the W. N. Matthews Corporation. The first of these is provided with a metering arrangement operated relative to the change in opening of the nozzle. The second gun has two separate cylinders, the plungers of which are both linked to the same trigger for relative action.

Materials

A cast-iron mixture especially adapted for chilled rolls was patented, 1,702,128, and assigned to the Mesta Machine Co. It contains from 2 to 4 per cent of carbon, 1.8 to 4 per cent of chromium, not over 0.30 per cent of phosphorus, not over 0.20 of sulphur, 0.10 to 1.5 per cent of manganese, and 0.50 to 2.5 per cent of silicon. The combination of silicon, chromium, and carbon causes a gradual merging of the iron in chilling into a core of mottled iron, which has a greater tendency towards white iron than the usual chilled iron.

A process for producing forgeable nickel was patented, 1,700,460, and assigned to the Bell Telephone Laboratories, Inc. It consists in adding small amounts of vanadium and magnesium to the nickel while in the molten state.

The Bakelite Corporation was assigned patent 1,703,414 on a process for making resin-impregnated sheets. The fibrous sheets are impregnated with a reactive plastic resin and the moisture expelled without reacting the resin.

A patent, 1,703,630, on an improved method of annealing sheet steel was assigned to the American Dressler Tunnel Kilns, Inc. It consists in interposing a layer of diatomaceous earth between each pair of adjacent metal layers.

Trade Publications

ENGINE CARE AND OPERATION. Mar Tan Motors, Inc., 837 29th St., Milwaukee, Wis., has published a pamphlet entitled "Care and Operation of the Mar Tan Model EB Engine." As well as the usual instructions the pamphlet contains specifications and an illustrated parts list. This is a small gasoline engine suitable for air compressors.

FRICTION CLUTCHES. The Carlyle Johnson Machine Co., Manchester, Conn., has published a loose-leaf catalog on Johnson friction clutches. This catalog covers the use of the clutch in various industries and on many types of machinery. The various types and sizes are shown, together with prices and dimensions.

JACKLIFT AND STACKER PRACTICE. The Lewis-Shepard Co., 168 Walnut St., Waterton Station, Boston Mass., has published a special lift truck edition of its publication "Jacklift and Stacker Practice," which is devoted exclusively to jacklifts, single lifts, and special-purpose skid platforms. All of this material is illustrated and, where necessary, descriptions are given.

MARINE GEAR SETS. The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has published bulletin No. D.M.F. 5128 entitled "A Triumph of Mechanical Engineering," which gives the history of the development of reduction gears for marine engines. This lists the installations of the Melville-Macalpine gear sets in various ships. The bulletin contains four 11x8½-in. pages.

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PNEUMATIC TOOLS. The Rotor Air Tool Co., 5905 Carnegie Ave., Cleveland, Ohio, has published Catalog No. 6, which shows pneumatic grinders in standard and high-production types, sanders, pneumatic drills, and various attachments and wheels for all of these tools. The catalog contains twenty 11x8½-in. pages.

STEEL SPECIFICATIONS. The Carnegie Steel Co., Subsidiary of the United States Steel Corporation, Pittsburgh, Pa., has published the eleventh edition of "Standard Specifications" for steel for bridges and buildings, locomotives and cars, boilers and boiler rivets, commercial and forging bars, reinforcing bars, forgings, railway and industrial wheels, and axles and shafts. The booklet contains 125, 7½x5-in. pages.

THREAD SPECIFICATIONS. John Bath & Co., Inc., 8 Grafton St., Worcester, Mass., has published a pamphlet entitled "Thread Specifications," which are those of the National Screw Thread Commission for Class 3—Medium Fit for nuts, screws, ground taps, tapped holes, thread plug gages, and thread ring gages. The material is given in the form of tables on loose-leaf pages. There are sixteen of these data sheets printed on 11x8½-in. pages.

TRANSMISSION PARTS, PRESSED STEEL. The American Pulley Co., 4200 Wissahickon Ave., Philadelphia, Pa., has published catalog B-26 entitled "American Pressed Steel Products," which describes and lists the sizes of pressed steel pulleys, shaft hangers, steel hand trucks, reels, spools, and drawn metal shapes. The catalog is well illustrated throughout and contains 116, 8x5½-in. pages.

AERONAUTICAL DESIGN. The National Advisory Committee for Aeronautics has issued two pamphlets of interest to aeronautical designers. Report No. 296 is known as "Pressure Distribution Test on PW-9, Wing Models from 18 through 90-Deg. Angle of Attack," by Oscar Moser, Jr. Report 314 is entitled "Drag and Cooling With Various Forms of Cowling for a 'Whirlwind' Radial Air-Cooled Engine—Part II," by Fred E. Weick. The first is available at 15 cents a copy and the second at 20 cents from the U. S. Government Printing Office, Washington.

ARC WELDING. The Lincoln Electric Co., Cleveland, Ohio, has published a pamphlet entitled "How to Begin the Application of Arc Welding in Production Manufacturing," which is a supplement to "Arc Welding—The New Age in Iron and Steel." The text is thoroughly illustrated by means of photographs and line drawings. The supplement contains 32, 9x6-in. pages. It may be obtained for 50 cents.

BUDGET CONTROL. Ernst & Ernst, accountants and auditors, 80 Maiden Lane, New York, N. Y., have published a book entitled "Budget Control, What It Does and How to Do It," this being the second edition. It tells how each kind of a business budget should be prepared, and the principles of its effective operation together with a summary of benefits. According to the book, the budget estimates the factors of time, volume and value necessary to produce a definite amount of sales and profit in a given period. It forecasts production, income, expenditures, financing, profit and financial position. The booklet contains 30, 9x6-in. pages.

EMPLOYMENT STABILIZATION. The Policyholders Service Bureau of the Metropolitan Life Insurance Co., New York City, has prepared, through the Research Committee of the New England Council, a bulletin entitled "The Use of Research in Employment Stabilization." Briefly, the contents are: Better Practices Based on Research, Selling Research Results to the Working Force, Control Labor Turnover, and Science and Personnel Stability. The bulletin contains 32, 11x8½-in. pages.

EXPORTING MACHINERY. The U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce, has published a bulletin entitled, "Shipper's Guide in Declaring Machinery for Export," effective January 1, 1929, which supersedes the old "Glossary of Terms," dated January 1, 1926. Several new classifications have been made for certain types of machine tools, of which the exporter should know when declaring machinery. Copies may be obtained from the U. S. Government Printing Office, Washington.

FOREIGN TRADE ADDRESSES INDEX. The National Foreign Trade Council, India House, 1 Hanover Sq., New York City, has published a bulletin entitled "Selected Index of Titles of Addresses on Foreign Trade" delivered before the annual National Foreign Trade Conventions from 1917-1928 inclusive. This index is a guide to original foreign trade material on 27 main topics of interest to the American foreign trader. It may be obtained free.

FOREIGN TRADE QUOTATIONS. The Foreign Commerce Department of the Chamber of Commerce of the U. S., Washington, has published a bulletin entitled "Warsaw Rules, 1928, Relating to 'C.I.F.' Contracts," which is a tentative draft prepared by the International Law Association. These rules are concerned with the "C.I.F" practice of selling goods, by which the seller gives a quotation covering the cost of the goods, the marine insurance on them, and all transportation charges to the foreign port.

GAS WELDING. The Air Reduction Sales Co., 342 Madison Ave., New York City, has reprinted "Development and Progress of Mechanical Gas Welding," by J. L. Anderson, of its engineering research department. This paper was read at the annual meeting of the International Welding Association, Chicago, November, 1928. Examples of the gas welding of pipe are shown.

LABOR TURNOVER. The Policyholders' Service Bureau, Metropolitan Life Insurance Co., New York, N. Y., has published a pamphlet entitled, "How High Should Labor Turnover Be?" The bureau has for several years been pooling the turnover experiences of 300 manufacturers, giving employment to 600,000 employees engaged in diverse industries and located in widely scattered parts of the country. A description of the system which has been developed and the graphic results are given in this leaflet. Employers have in this medium an opportunity to pool their labor turnover statistics and to receive in exchange useful monthly comparisons or graphic charts.

MARINE SIMPLIFIED PRACTICE. The U. S. Department of Commerce has published bulletin RX-28, entitled "Simplified Practice in the Marine Field," which gives the organization of the American Marine Standards Committee and its constitution and rules as revised in 1928. This bulletin contains a list of publications of standards promulgated by the committee. It contains eighteen 9x6-in. pages and may be obtained from the U. S. Government Printing Office, Washington, for ten cents.

PRODUCTION EXECUTIVE'S FUNCTIONS. The Policyholders Service Bureau of the Metropolitan Life Insurance Co., New York, has published bulletin No. 12, of a series on business organization, entitled "Functions of the Production Executive." The bulletin contains opinions from many persons and shows graphically the place of the production executive. The bulletin contains 26, 8x5-in. pages.

SAFETY IN WELDING. The Policyholders Service Bureau of the Metropolitan Life Insurance Co., New York, has published a bulletin entitled "Safety in Welding," which presents the outstanding health and accident hazards involved, with suggestions for overcoming them. The bulletin is well illustrated.

SIMPLIFIED PRACTICE. The U. S. Department of Commerce, Bureau of Standards, has published bulletin RXI-28, entitled "Simplified Practice, What It Is, and What It Offers,"—1928 edition. This bulletin is a summary of the activities of the Division of Simplified Practice, and a description of the services offered the American industries. It may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington, for 15 cents.

News of the Week

Automotive Shop Methods to Be Explained

Automotive manufacturers in Detroit will show how their management and material handling methods can be applied to other industries at a national meeting of the management and material handling divisions of the A.S.M.E. to be held in Detroit, May 1-3, at the Book-Cadillac Hotel. The program presents leading methods used in the automotive industry, and the papers will be supplemented by inspection trips to various plants, including the River Rouge plant of the Ford Motor Co. and other leading automobile plants.

The program officially opens at 2 p.m. Wednesday with a paper on "Management as Applied to Materials Handling," by James Lynah, director of staff, works managers' committee, General Motors Corporation. The author discusses management problems due to modern increased production methods (such as pace making conveyor systems) and the control of materials including an analysis of the resulting effects upon labor. "The Modern Forge Shop" is being presented in the next paper by Hugh Dean, manager of the Chevrolet forge shop, one of the largest in the world. The last paper of the first session will be by L. W. Pardee, manager of the Wilson Foundry, on the subject of "Foundry Handling as a Continuous Process."

The evening session opens with a paper on "General Survey of Modern Methods of Production," by John M. Carmody, editor, *Factory and Industrial Management*. The rest of the evening will be given over to sheet-metal handling with a paper by Charles Malpas, Fisher Body Corporation, who will discuss "Management, Layout and Waste of Sheet-Metal Shop." He will be followed by R. R. Reese, Packard Motor Co., who will discuss "Handling of Sheet Metal Stampings."

The Thursday afternoon technical session opens with a paper on "Body Building," by Vincent Dirkes, Fisher Body Corporation, which discusses the fabrication of the body in motion. The next paper by Otto H. Clausmeyer, Studebaker Corporation, will discuss "Cleaning, Painting and Drying Operations," as they are accomplished on moving conveyors. The session will close with a paper by J. H. Porter of the Chevrolet Transmission Plant, Toledo, Ohio. This describes "Machine Shop Methods of Continuous Handling," and includes from the raw state to the final transmission assembly.

There will be a banquet on Thursday with many notable leaders of industry at the speakers' table.

The Friday afternoon session has as its opening paper, one on "Handling of Miscellaneous Parts," by L. A. Churgay, Sr., Chrysler Corporation. The second paper will be on "Material Control to Assembly," by Howard Flagg, member of advisory staff, general Motors Corporation, and will cover scheduling and control of flow to the assembly of varied finished products. The last paper will be on the "Operation of the Assembly Line," by Gordon LeFebre, vice-president in charge of operation, Oakland Motor Company.

The Friday evening session is given over to the application of methods of production which may be termed "Automotive" as they are being introduced in other fields. The first paper, by C. W. Avery, president of the Murray Body Corporation, will discuss the "Revolution Now Taking Place In the Glass Industry Through the Introduction of Automotive Methods." "The Applications to the Electric Industry," will be discussed by E. L. Spray of the Westinghouse Electric & Manufacturing Co. Alvin G. Sherman, general manager, Detroit Vapor Stove Co., will discuss "Applications of Production by Conveyor Methods to Sheet Metal and Enameling." The session will close with a discussion of "Applications of Conveyor Methods to Molding Operations," by H. M. Lane, president of the H. M. Lane Co., Detroit.

Aeronautic Meeting in Detroit

The Detroit section of the Society of Automotive Engineers is to be host next week during the national aeronautic meeting of the Society being held on April 9 and 10 at the Book-Cadillac Hotel. Most of the papers to be presented deal with intimate details of aircraft design, and it is interesting to note that two of them will be devoted to gliding and soaring flights. Other features will be a visit to the Ford airport and an inspection of the factory, and visits to the Detroit Aircraft Show, being held simultaneously.

Foreign Trade Convention in Baltimore

The sixteenth annual foreign trade convention of the National Foreign Trade Council is to be held in Baltimore, April 17-19, at the Lord Baltimore Hotel. James A. Farrell, chairman of the Council and president of the United States Steel Corporation, will open the sessions with an address on World Trade, Today and Tomorrow. Don Carlos G. Davila, ambassador from Chili, will talk of South American trade, while W. McL. Clarke, secretary-general of the Canadian Chamber of Commerce, will speak of Canada's trade with the United States.

Among the other topics to be discussed at later sessions are: New Merchandising Developments, Installment Selling for Export, and Credit Insurance. Under the last subject, J. L. Thompson, credit manager of the Yale & Towne Manufacturing Co., will explain the situation in the United States, while Dr. G. G. Huebner, of the University of Pennsylvania, will describe European practice. Air transport for commerce is also to receive attention.

Chamber of Commerce Also Meets Soon

An appraisal of current economic problems in this country and their effect upon future business development will be made at the seventeenth annual meeting of the Chamber of Commerce of the United States to be held in Washington, April 29 to May 3. The subjects listed in the preliminary program reflect in a large measure some of the significant economic changes that are now taking place in industry, finance and commerce. Foremost among these questions are: What is the future of Small Business? Credit Supply and the Stock Market; the Making of a Tariff; the Impact of Science on Business; and Taxation.

The work of the five-day meeting will be carried on in six general sessions and twelve round-table conferences. Among the subjects to be discussed in the latter groups are: Trade Practices; Industrial Expansion and National Manufacturing Capacity; Government Policies Relating to Raw Materials; Credit Supply; Conservation of Life and Property; and Employer-Employee Relations.

Houston Heads Baldwin Locomotive Works

George H. Houston has been elected president of the Baldwin Locomotive Works, succeeding Samuel M. Vauclain. Mr. Houston is an associate of the Fisher Brothers of Detroit. Mr. Vauclain was elected chairman of the board of directors of the Baldwin company. The former chairman, Thomas S. Gates, was elected chairman of the executive committee.

Mr. Vauclain has been president of the Baldwin Locomotive Works from May, 1919, and under his management it has enjoyed the most prosperous period of its history. During this period the new works at Eddystone was built and the removal of all of the company's activities from its old plant in Philadelphia was completed. He has been connected with the company and

its predecessors for forty-five years in various capacities from foreman to general manager.

The action was said to be the first step in the rehabilitation of the company planned by the Fisher-Cutten interests, who now hold control. The plan, it is understood, calls for a splitting of the stock and acquisition of control of other companies. The Fisher brothers and Arthur W. Cutten of Chicago, have held stock control of Baldwin for more than a year and a half.

Foundry Production and Other Indices

Foundry production was 11 per cent above normal during the month of February, according to data compiled by the Gray Iron Institute from figures received from 84 foundries. Production for this group is 21,860 tons as against an average monthly production during the last three calendar years of 19,550 tons by the same number of foundries. New business received during the month and unfilled orders at the close of the month were also about 11 per cent above normal figures. Of 77 foundries reporting, 47 reported conditions good, 29 fair, none poor, and one bad.

A similar index was given by the Department of Commerce for steel castings. New orders for steel castings in February were reported by the principal manufacturers as 79 per cent of shop capacity as against 85 per cent in January and 62 per cent a year ago. The production of steel castings was 67 per cent of capacity in February as against 64 per cent in January, and 60 per cent a year ago. The 128 concerns reporting have a present monthly capacity of 146,000 tons, representing over four-fifths of the commercial castings capacity of the United States.

February shipments of electric industrial trucks and tractors as reported to the Department of Commerce by the eleven leading manufacturers in the industry were 133 as compared with 152 in January and 119 in February, 1928. The lowest index figure last year was 96, the highest being 153 in December.

The total apparent consumption of babbitt metal showed a falling off in February, but was still well up as compared with leading figures in 1928, according to reports received by the Department of Commerce from 31 firms. The total consumption was 5,720,243 lb. as compared with 6,093,267 in January, and 4,470,368 in February a year ago.

Ford Production

The Ford Motor Co. has reached a capacity of more than 8,000 cars a day and employs nearly 130,000 men. The airplane business in the past year has increased very rapidly and plans are now being made for the production of considerably more than one plane every two days. These planes are of the large freight-passenger type.

Automobile Part Makers Have Record Quarter

As a result of record automobile and truck production, manufacturers of automotive parts and equipment have had the greatest first quarter of a year in the history of their industry, according to the Motor and Equipment Association. The association predicts also a record first half year. Wholesalers of service parts, accessories and shop equipment also have done more business than a year ago.

"Shipments of parts, accessories and garage equipment to vehicle makers and the wholesale trade in February reached an index figure of 212 per cent of the January, 1925, base, a new high," the report continues. "This compares with 188 in January this year, 171 in February last year and 146 in February, 1927."

Cadillac Expansion

As was announced last week, the Cadillac Motor Car Co. is to spend more than $5,000,000 on expansion made necessary by the demand for Cadillac and LaSalle cars. This does not include changes that will be necessary in the Fisher body plants and in other General Motors units which supply Cadillac with parts and accessories. The program, which is to cover a two-year period, includes a new automatic screw machine building which with machinery and equipment will cost $750,000, a large addition to the iron foundry, an addition to the chrome-, copper- and nickel-plating division, and a large addition to the LaSalle assembly plant. The proposed expenditures will give the company a capacity of 60,000 cars a year, double the present capacity.

General Electric Reports Increase in 1928 Net

Earnings of the General Electric Co. for 1928 amounted to $54,153,806 as compared with $48,799,488, in 1928, according to the annual report of the company made public by President Gerard Swope. Orders received during the year amounted to $348,848,512, compared with $309,784,623 in 1927, an increase of 13 per cent. Unfilled orders at the end of the year were $72,953,000 compared with $68,916,000 at the close of 1927, representing an increase of 6 per cent. A surplus of $8,313,495 was carried over to this year. The International General Electric Co., which handles all export business, yielded a profit available for dividends of $1,681,735 compared with $1,556,335 in 1927.

The company's manufacturing plant investment at the end of the year had a cost value of over $200,000,000, but deducting about 160 million of reserve, the net book value was $47,556,811. At the close of 1928, inventories were $63,776,149 and shipments $337,189,422, the ratio being 18.9 per cent, showing double the turnover of inventory as compared with that of 1920.

The average number of employees during 1928, not including those of associated companies, was 73,526 and approximately 58 per cent of these have served the company five years or more. Nineteen per cent of all employees in 1903 and 26 per cent of those on the payroll in 1908 are still in the company's service, according to the report.

General Motors Reports

The twentieth annual report of General Motors Corporation covering 1928 shows that the company manufactured 40 per cent of the cars produced in the United States and Canada in the year, but that motor car operations contributed only about one-half of its total profits. Net earnings for the year amounted to $276,468,108, after all charges. This showing compared with a net of $235,104,826 in 1927, which figure was bettered by 17.6 per cent last year. Surplus was from $187,819,083 to $285,458,594. Sales amounted to $1,459,762,906 as compared with $1,269,519,673 for 1927, a gain of 15 per cent.

Machinery Needed for Flood Control Work

An appreciable portion of the $30,000,000 that the government is going to spend during 1929 for flood control work on the Mississippi will be used for the purchasing of machinery, the War Department has announced. Although it is the policy of the Army Engineers in charge of the work to let it out under contract whenever practicable, it is pointed out that whoever performs the actual operations will have to buy the necessary equipment. It is not believed that there will be a necessity for buying much new dredging equipment, but it is expected that there will be heavy purchases of concrete mixers, levee machines, and other similar apparatus.

Huge Hydraulic Turbines Ordered by Soviet

An order for four of the largest hydraulic turbines and generators ever constructed has just been placed for shipment to the Soviet Union by the Amtorg Trading Corporation, of New York, with the Newport News Shipbuilding and Drydock Co., and the International General Electric Co. The order involves an outlay of about $2,500,000, and the credit terms allow for payment during a five-year period. The equipment consists of four hydraulic turbines of 18,000 hp., direct connected to four vertical electrical generators of 77,500 kva. capacity. They are to be used in the Dnieper hydro-electric plant now being constructed in the Ukranian Soviet Republic.

Increased Sales of Industrial Machinery to Great Britain

WITH the continued improvement of economic conditions in Great Britain, there has been a steady increase in demand for foreign industrial machinery, according to a report issued by the industrial machinery division of the Bureau of Foreign and Domestic Commerce. Thus the value of imports for 1927 exceeded that for 1926 by 29 per cent, while the five items for which figures covering 1928 are available, show a distinct total gain over 1927 figures.

The latest detailed statistics available are those for 1927. These show that during that year the United States was first in the trade and furnished Great Britain, our best customer, with £5,469,464 worth of industrial machinery which represented an increase of 34 per cent over the preceding year. Germany, the second most important supplier, also increased its business substantially. Of total British imports of industrial machinery by value during 1927 the United States furnished 53 per cent and Germany approximately 20 per cent.

During 1927 as compared with 1926, shipments of industrial machinery from the United States to Great Britain showed gains generally all along the line, increases being particularly notable in the case of boilers and boiler house plants, cranes and other lifting machinery, machine tools, pneumatic tools; paper cardboard and carton making machinery, pumps and textile weighing and woodworking machinery. Decreases are to be noted, however, for air and gas compressors and exhausters, filter presses, grain milling machinery, and internal-combustion engines.

German Sales Also Gained

German sales to Great Britain showed important gains in most cases, including machine tools. While second to the United States in most of the important items, German sales to Great Britain of conveyors and transporters, hydraulic machinery, sugar making and refining machinery, steam prime movers, and paper, cardboard and carton making machinery, considerably exceeded those of the United States.

Among the smaller suppliers, Sweden led in sales of ball and roller bearings, while Belgium ranked second only to the United States in woodworking machinery, and Sweden was exceeded only by the latter country in sales of pneumatic tools and refrigerating machinery and by Germany in shipments of paper making machinery.

Metal-working machine tools, which are second only to textile machinery in British imports, have shown a steady upward tendency during the past few years reaching a high of £1,404,059 in 1928 as against £924,163 and £1,180,595 in 1926 and 1927, respectively. Machine tools constitute the chief item of machinery imports to Great Britain from the United States, and in 1928 the latter's share in this business was 44 per cent in tonnage and 62 per cent in value, representing but little change from the preceding year. Germany participated to the extent of 46 per cent in tonnage, but only 31 per cent in value, which is significant as indicating the predominance of American high-class machine tools, such as special single-purpose machines, and precision and high-production tools. Moreover, American participation in this line is steadily growing due to the adoption of better production methods on the part of British industry, especially the automotive manufacturers.

Among the other items for which figures covering 1928 are available, imports of boilers and boiler house plant showed a substantial increase over the previous two years, but shipments of paper making machinery fell off as compared with 1927 although they increased over 1926. Moreover, with the depressed conditions in the coal industry and the closing of a large number of mines, imports of mining coal cutters continued to decline, falling by £32,995 under 1926 and by £18,696 under 1927.

Data on Canadian Pulp Machinery Builders

A mass of information pertaining to the pulp and paper machine industry in Canada is embodied in a ready-reference map prepared by the Department of the Interior of the Canadian Government. One may see from a glance at the map the chief centers of manufacture of pulp and paper machinery. Another point well depicted is the small degree of manufacturing carried on along this line in the western provinces, although the manufacture of pulp and paper is a growing industry there, especially in British Columbia. A compact directory gives the names and addresses of companies manufacturing machinery peculiar to the pulp and paper industry and a second directory gives a classified list of products and the names and addresses of companies handling pulp and paper machinery.

Taylor Society to Meet in Charlotte, N. C.

A number of management problems common to the metal-working and other industries will be discussed at the spring meeting of the Taylor Society to be held May 1 and 2, at Charlotte, N. C., in the Chamber of Commerce auditorium. Headquarters of the convention will be at the Hotel Selwyn. On the morning of the first day, a general perspective session will be held covering budgets and schedules and market analysis. In the afternoon simultaneous departmental papers will be presented on the major problems of sales and production management. In the latter group equipment control, materials control, process control, and the problem of training personnel will be included in the discussions. In the evening there will be a public address on the importance of good management to the industries of the region.

On the morning of May 2, there will be simultaneous round-table conferences on the selection and training of workers, the maintenance of equipment, the control of operation, and retail store management. In the afternoon there will be similar round-table conferences on time study and rate study, control of materials, accounting and statistical records, and retail store management.

Welding Society Issues Tentative Program

The tentative program for the annual meeting of the American Welding Society, to be held in New York City, Engineering Societies Bldg., April 24 to 26 is as follows:

WEDNESDAY, APRIL 24

Business Session, 10 a.m.

F. T. Llewellyn, president, presiding

Report of president, election of officers, presentation of Miller Medal.

Technical Session, 10:30 a.m.

Symposium on "How to Organize and Operate an Industrial Welding School."

Technical Session, 2 p.m.

F. M. Farmer, presiding.

Physical Properties of Butt Welds, by G. LOBO, Westinghouse Electric & Manufacturing Co.

Welded Pipe Joints (author to be announced later).

Evening

Board of Directors Meeting

THURSDAY, APRIL 25

Technical Section, 10 a.m.

F. T. Llewellyn, president, presiding

Design of Joints for Welded Steel Structures, by A. VOGEL, General Electric Co.

Welding in the Heating and Ventilating Industries, by PROF. S. E. DIBBLE, Carnegie Institute of Technology.

Technical Session, 2 p.m.

A. G. Oehler, presiding

Welding in the Aircraft Industry, by R. M. MOCK, Bellanca Aircraft Corporation.

Thermit Welding of Rail Joints for Main Line Track of Steam Railroads, by J. H. DEPPELER, Metal & Thermit Corporation.

Annual Dinner, 6:30 p.m.

FRIDAY, APRIL 26

Technical Session, 10 a.m.

Symposium on Welding in the Chemical and Process Industries.

Welding Aluminum in the Chemical Industry, by W. M. DUNLAP, Aluminum Co. of America.

The Production of Ductile Welds in Nickel and Monel Metal, by N. B. PILLING, International Nickel Co.

Welding in the Gas-Handling Industry and Requirements of Welding in the Chemical Field, by R. S. MCBRIDE, assistant editor, *Chemical and Metallurgical Engineering.*

Welding of Pressure Vessels for High Temperature and Pressures, by T. MCLEAN JASPER, A. O. Smith Corporation.

Annual Meeting, 2 p.m.

American Bureau of Welding

Meeting of Structural Steel Welding Committee, J. H. Edwards, chairman.

BUSINESS BAROMETER . . . . *In many lines, trade is larger than ever in the history of the country and is yielding a more satisfactory profit than in some time*

By THEODORE H. PRICE

Editor, Commerce and Finance, New York

From this page the reader will get a quick picture of current business and industry. The boxed material below is a summary of the letters from regional correspondents of the American Machinist, published in full on the opposite page.

THE world's attention continues to be focused upon the American stock market. The term American stock market is used advisedly for the liquidation that broke out early last week includes not only New York but several other important cities that have local stock exchanges where local securities are traded in.

As the recent speculative boom developed, the brokers who are members of these local stock exchanges became borrowers of considerable sums, and when the repayment of these loans was called for last week the decline that ensued was in some cases sensational. Among the holdings that were thrown overboard were commodities as well as stocks, and the violence of the fluctuations undoubtedly will place March 26 with the other prominent and sadly-remembered days in the annals of the American markets. The result has been a partial clearance of the situation, and on the New York Stock Exchange a sharp recovery occurred, which continued until the markets were closed for the Easter holidays.

But the reduction of $144,000,000 in brokers' loans, reported by the Federal Reserve Bank of New York on last Thursday afternoon, does not reflect any important change in the situation. The figure is less than the increase of $166,000,000 during the previous week, which raised the total to a new high record. And the bankers who came to the rescue of the market when the call money rate rose to 20 per cent made it clear that their assistance was offered only to mitigate the severity of the crisis, and would continue available only as long as a recurrence was threatened.

The attitude of the Federal Reserve Banks is unchanged and their weekly statement reveals that they are still reducing the amount of credit they are supplying, except as they lend to member banks who can convince them that the money is wanted for strictly commercial purposes.

Therefore it is a mistake to interpret the lower call rate at the close of the week as a sign that the money market is coming back to normal, and until it does so a resumption of the boom will be about as logical as the recovery of a sick man whose temperature ranged around 106.

As those who have followed these articles will realize, the writer has not been in sympathy with the widely speculative enthusiasm that so long persisted in the security markets. He has felt that it was a form of inflation indirectly due to our abnormally large gold holdings, and that it would lead to a dangerous distention of credit. But now that it is possible that, barring further large gold imports, the speculative expansion has been checked, he is disposed to advise against the acceptance of predictions that are unduly pessimistic, and to urge a recognition of the essential soundness of the commercial position in America.

In most lines trade in this country is excellent. In many it is larger than ever before in the country's history, and is yielding a more satisfactory profit than has been the case during the last few years. The steel industry is running at capacity, and production is breaking all records without visibly adding to stocks, and the mills have large backlogs of unfilled orders. Copper has probably been allowed to go too high. The leaders in the development of the electrical industry are said to be investigating the use of substitutes. The readjustment of the market may cause some pain to those who are long of either copper stocks or the metal.

A recession in the building industry is admitted, and a recovery cannot be expected until money becomes permanently easier again. The automobile industry is making more cars and the rubber manufacturers more tires than they are currently selling and some falling off in activity during the next two or three months is likely. But the best selling season is still ahead of them and as expectations are not extravagant the outcome should not be disappointing. Employment, of course, is at a new high level.

Distributive trade generally, is sound, and if the American people do not lose their heads as the stock market is liquidated, the position ought to be greatly clarified and helped by the process. This is not to say that a liquidation of the stock speculation will not reveal some sore spots as it proceeds. But the securities markets are but one small section of American business, though a vastly important one, and there is reason to hope that those who have been speculating more than usual in other people's business have been less venturesome in their own.

A necessary antecedent of deflation is inflation, and about the only effects of the boom upon commerce and industry is that production in a few lines has been slightly overstimulated. A moderate recession will cure this, provided the necessity is recognized in time, and modern business administrators undoubtedly are better able to keep output and ultimate consumption in tune than any of their predecessors.

Business continues insensitive to the disturbances in Mexico and China, and the impending reparations settlement will be cheerful in itself irrespective of its terms. The great question mark of international finance, and indeed of all American business, is whether gold will move to this country.

CONDITIONS in the machinery and machine tool industry are almost universally excellent, now that the South reports March the most active month this year with a large volume of sales and inquiries recorded in the last fortnight. This is the only district where the volume of business transacted in the first quarter was below that of last year, but apparently a change for the better is rapidly taking place. In other centers also increased business was noted in the closing days of March. This was particularly true of Chicago, where the total volume of sales in the past month reached record-breaking proportions. In New England, on the other hand, activity was less in the last two weeks of the month than in the first, but the month as a whole was excellent.

LESS hesitancy on the part of purchasers in placing orders is seen by the Cincinnati builders, due no doubt to the pressing delivery situation. The problem of delayed deliveries is said to be the chief one in the Chicago market, and it is having its effect upon sales in New York also, as well as in New England. Although most of the leading builders have increased their schedules of production, they are hampered to a large extent by the scarcity of skilled help in all sections of the country.

RAILROAD buying of shop equipment is considerably ahead of last year in the Chicago district, even though the closing of lists is a slow process. In the South, too, railroads are placing some good-sized orders, and in Canada purchases of rolling stock by the roads is largely responsible for the unprecedented activity there. Bridge construction by some of the railroads is keeping some of the Canadian steel mills very active also.

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The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CINCINNATI

Several of the machine tool manufacturers of the Cincinnati district report an increased volume of sales in the past week, but the great majority report that business was practically at the same satisfactory level as in the previous week. Buying is being done with less hesitancy than heretofore, it is stated, and there is less lapsed time in the average case between the receipt of the inquiry and the placing of the order. Local selling agents also report an excellent volume of sales in the week, and state that those in need of tools are showing less hesitancy in making commitments.

An increased percentage of the week's orders called for two or three pieces of equipment, but the great majority of the orders were for single tools. The week's inquiries were large in number and of excellent tone. An increasd number of the inquiries were in regard to two or more tools, but the great majority were in regard to single tools, for replacement purposes.

In the week production was at a good level and manufacturing conditions continued to be favorable. However, skilled labor has become scarce, and for this reason it is feared that a further increase in the demand may in some cases cause a delay in making shipments.

CHICAGO

Additional impetus seems to have been given to machine tool sales within the last week. Already having reached what amounts to a record in the total amount of business transacted in March, the final days of the month have shown even increased activity. In no line of tool production has there been reported a letting up. The chief problem at the present time, one that is almost universal, is that of deliveries, which continue far behind, notwithstanding that most machine tool building plants are working overtime, and with increased forces.

As an illustration of the high level which has been reached for the first quarter of 1929, it may be mentioned that the local representative of a big Eastern tool manufacturing concern reports that business for the first three months of this year will be three times larger than for the corresponding period of 1928. A number of comparisons of like character are reported.

Railroad buying is considerably ahead of last year up to this time, and the closing of lists, when completed, will show a satisfactory total of sales in railroad shop equipment; the closing, however, is a slow process. The Allis-Chalmers Manufacturing Co., Milwaukee, and the Pullman Co., Pullman, Ill., have recently placed some good orders, the latter for its plant in Birmingham, Alabama.

CANADA

Industrial operations generally throughout Canada are on a broader scale than they were two weeks ago. Demand for machine tools, mining and electrical machinery, agricultural implements and other such requirements for the new season is well maintained and everything points to a very active year in the metal-working industry. Structural steel mills are well booked with orders, foundries and car shops are much busier than at this time last year, and the automobile factories are taking on additional workers.

Much of the car companies' prosperity is due to the greatly increased buying programs of the railway companies. More box cars are now being ordered than ever before, and present business is sufficient to occupy the makers for many months to come. The structural steel mills are encouraged by the announcement that the Canadian Pacific Railway has drawn up an extensive program of bridge replacement, relaying of steel, erection of stations and other improvements affecting scores of points in Western Canada and running into millions of dollars.

The Canadian Steel Corporation at Ojibway is planning further additions to its wire plant, and the Dominion Alloy Steel Corporation at Sarnia, Ont., is installing equipment for the production of black sheets, which will be processed from imported steel bars. The president of the Dominion Foundries and Steel Co. Ltd., reports that business conditions are good and some departments are sold out for many months.

The bridge companies are unusually busy. The Dominion Bridge Co. is reported to have orders on hand sufficient to keep the plants busy for three years. The Hamilton Bridge Co. has secured a contract from the C.P.R. to fabricate and build four steel bridges in British Columbia.

Continued expansion in the automobile industry is indicated by the announcement that the output of 31,287 vehicles in February was the highest reported for any February to date and was only exceeded in May of last year, when the monthly record was established at 33,942 cars.

NEW ENGLAND

New England industrial activity is at its height. Order balances are large, and there is still a crying need for first class, experienced help. This is something to be taken into account if order balances are to be brought to the desired proportions and better deliveries assured.

The current week showed no material change over the previous week in the matter of orders, and it is likely the first half of March was somewhat better in this respect than the last half. In spite of this decline during the past two weeks, March will rate an excellent month with machine tool builders. Some dealers, experiencing an early shortage of grinding units, lathes, and other equipment, have not done as well in March as in February. Most builders and dealers, however, report excellent prospects and a high level of business throughout March.

Inquiries were noteworthy. A new group of likely looking requirements included production units for a Middle West automobile manufacturer, an Eastern airplane engine builder, and a large radio manufacturer. A number of small metal-working companies doing contract work anticipate the purchase of new machinery.

Grinding equipment is a leading New England seller. Power hammers are in good demand. All kinds of large production lathes call for extended deliveries. Boring machinery and tools sell well, and an increased demand for this equipment is notable in the aeronautical field. In Connecticut latest statistics in this industry show 100 and more companies producing for aircraft companies. The state has nine airports and more than a dozen landing fields. Products produced include hangars, fabrics, pontoons, rubber utilities, aluminum propellers, plywood, wood sections, hardware, bearings, gaskets, screws, gears, small copper and brass tubing, valves, electrical supplies, and radiators, in addition to machinery and motors.

DETROIT

With all motor car and accessory manufacturers engaged in record production schedules and with innumerable small tool and die shops starting up to take care of the overflow, the machinery and machine tool business in the Detroit area is in as healthy a state as it has ever been in. Orders for all types of equipment are coming in regularly and with perhaps a slightly increasing volume. Inquiries are mounting up and the general prospects of the trade are extremely favorable.

There have been no outstanding orders of late and no one manufacturer seems to be doing anything particularly spectacular. The announcement of the Cadillac expansion, the general expansion of all General Motors organizations and the steadily increasing production of Ford plants are perhaps among the most interesting developments. Chrysler plants are all very active and are in the market for a good deal of equipment. Graham-Paige is advancing steadily, and is making a special effort to complete its line of trucks.

The Motor Wheel Corporation of Lansing is engaged in a heavy production schedule but is not buying any machinery at present. Packard, Buick, Studebaker, Olds, Oakland and Reo are all very active and the Briggs Body Co. has announced greatly increased earnings within the past year.

Employment in Detroit, Lansing, Flint and Pontiac is still showing large increases and the general atmosphere throughout the entire state is highly optimistic.

Chevrolet has increased its 1929 quota from 1,250,000 to 1,350,000. Almost all of the large manufacturers report greatly increased foreign business and prospects for still larger growth within the present year. Aviation is taking up some of the attention of dealers.

Altogether the prospects for the machinery business in this district seem brighter than they have been in many years.

SOUTHERN DISTRICT

Though bad weather conditions have adversely affected machinery and machine tool business in the district ever since the first of the year, the latter part of March brought a turn for the better with larger sales reported than at any time this season. Inquiries also picked up considerably, and judging from their tone business should continue active through the late spring and early summer period. For the first quarter of 1929 sales as a whole were somewhat less than they were for the same period in 1928, but still better than most distributors had expected, and they look for second quarter business to be quite a bit better than last year.

The textile mill demand is the feature of the market at present, and some exceptionally good orders have recently been placed for large mill projects now under way, and the outlook is the best it has been in years. Woodworking machinery sales have been slow due to inclement weather, but distributors look for considerable improvement the next few months, especially in the furniture manufacturing field in Georgia, Tennessee and the Carolinas. Demand for contractors' equipment has also been slow due to bad weather.

but the outlook is much improved in this field. Railroads are placing a few good orders for heavy equipment, and their inquiry is sufficiently heavy to indicate good business in this field during the late spring and summer.

NEW YORK

One of the most active quarters in the past decade has just been closed in the machine tool market in New York, measured by the volume of orders received in that period, and judging by present inquiry and orders pending no appreciable let-up is seen for some time to come. In one instance, however, a decrease in the volume of inquiries was noted, in this case to the satisfaction of the manufacturer, who looked upon the pace set in the last three months as too fast for healthy business. Some machines were said to be sold up to January, others to June. As a leading dealer put it, most of the manufacturers of production machinery are steadily falling behind in production, and hence in delivery, as the volume of unfilled orders continues to rise. In many cases, the factor of delivery is the governing one when the orders are placed.

Aeronautical activity is still having its effect upon the local market for tools. The Wright Aeronautical Corporation has bought some miscellaneous equipment in the past fortnight, as has the American Cirrus Engines Co., which has begun to produce a 4-cylinder, straight-line air-cooled engine at Belleville, N. J. It is also anticipated that Fairchild interests at Farmingdale, L. I., will soon start production on the Genet radial engine, for which they have the rights to build. Another firm that is expected to feature prominently in engine building is the E. W. Bliss Co., which is now building the Bristol "Jupiter" motor.

Sales made by the Triplex Machine Tool Co. in the past week included: a Swiss jig borer, two Ames bench lathes, two Rivett internal grinders, two hand millers, a spring coiling machine, an Excel filing machine, and two Boley multiple drilling machines.

Business Items

A number of changes were made in the direction of the Adamson Machine Co., Akron, Ohio, at a recent meeting of the board. W. E. SLABAUGH was elected director to succeed the late Alexander Adamson, who was also president and general manager. R. B. COONTZ, formerly secretary and treasurer, was elected president and general manager, and C. L. FENN, formerly assistant treasurer, was elected secretary and treasurer, while L. S. DUDLEY was elected assistant secretary and treasurer. Mr. Adamson had been actively associated with the company since its founding in 1893, until his death on March 3. Mr. Coontz has been secretary since the incorporation of the firm in 1909, and Mr. Fenn has been associated with the company for a period of seventeen years.

The Package Machinery Co., Springfield, Mass., has made arrangements with the Forgrove Machinery Co., Leeds, England, to exchange ideas and patents. The Package Machinery product is to be handled by the Leeds and affiliated companies, and should they prove a strong seller in England will be manufactured by the Forgrove company. E. Lovell Smith, chief engineer for the Springfield company, will make a trip to England for further surveys of the situation. Cigar and chocolate wrapping machines will be manufactured here under British patents.

The Chrysler Corporation will erect an addition to the Newcastle (Ind.) plant to relieve congestion in the machine and assembly departments, and provide for future expansion. The addition will be 160 ft. wide by 300 ft. long. The addition is to take care of an expansion program in the front axle and automatic departments. No estimate was given as to cost, but it was said the building will provide employment for 200 men. A 60-ft. annex to the forge department has been constructed to house the shearing department and steam hammers.

The American Brass Co., Waterbury, Conn., Anaconda Copper Mining Co. subsidiary, has purchased the French Manufacturing Co., Waterbury, manufacturer of smallest sizes of seamless brass and copper tubing. The French concern will continue to operate as a separate unit. Officers of the company were elected as follows: Chairman of board, John A. Coe, president of the American Brass Co.; president, Fred W. French; vice-president, Leon H. French; and secretary-treasurer, Clifford H. Hollister.

SKF Industries, Inc., 40 East 34th St., New York, N. Y., announces address changes in three of its district offices. The Buffalo office has moved from 517 Manufacturers and Traders Bldg., to Main and Genesee St.; the Detroit office, from 6520 Cass Ave. to 2820 E. Grand Boulevard; and the San Francisco office from 115 New Montgomery Street, to 221 Eleventh St., the personnel of the various offices remains the same.

Williams, White & Co., Moline, Ill., will enter the washing machine manufacture field soon upon quantity production schedule, Harry Ainsworth, president, has announced. Since the last of the tri-city automotive concerns has withdrawn from the field, the plant, which has had big business from those factories and in the automobile body making field, has been seeking a new field of activity.

The National Bronze and Aluminum Foundry Co., of Cleveland, has just broken ground for a large addition to its plant which will increase its present capacity by 50 per cent. Some equipment has already been purchased, but it is expected that further equipment will be needed before the building is entirely utilized. The space is to be devoted to the increased production of "Tenual," an oxide-free alloy of aluminum.

The Bullard Co., Bridgeport, Conn., held its annual meeting March 20 and elected Faris R. Russell, of White, Weld & Co., New York, a director to succeed Harold C. Bullard. Officers were re-elected. Directors declared a dividend of 40 cents a share payable March 30 to stock of record March 19.

The Canadian National Railways are this season completing a locomotive repair shop in Montreal, foundations for which were constructed during 1927. This building will replace present facilities at Point St. Charles and will occupy an adjacent area. The locomotive shop will house under one roof all departments having to do with the rebuilding and repair of locomotives.

The entire assets of the Sykes Co., of Loganport, Ind., manufacturer of metal doors and frames and heavy steel stampings are to be liquidated at auction during the month. The Industrial Plants Corporation, 25 Church St., New York, N. Y., has been engaged to handle the sale of the equipment, which consists of large brake shears, power presses, and machine tools.

The Danly Machine Specialties, Inc., Chicago, makers of standardized die sets, have recently opened a warehouse and assembly plant at 16 Commercial St., Rochester, N. Y., in charge of A. F. Wallace, formerly of the New York office of the company. A complete stock of die sets and die makers' supplies will be carried.

The Curtiss-Reid Aircraft Co. Ltd., of Canada, has let a contract for the construction of an airplane manufacturing plant in Montreal. The plant, as designed, will have an annual capacity of 350 to 400 planes. Construction work has already started. The company now has on its books orders for a large number of planes.

The Vincent Steel Process Co., 2519 Belleview Ave., Detroit, Mich., has bought a new brick and steel building at 2434 Belleview Ave., which will double present production capacity. The company will be in full operation in the new plant about April 15. The building embodies modern equipment for heat-treating purposes.

Production of the American Cirrus engine has begun in a new plant in Belleville, N. J. Capacity of the plant will eventually be 15 engines a day, it is stated, and it is expected that 10 engines a day will be produced by July 1. The engine is an 80-hp. straight-line, four-cylinder air-cooled type.

The Pittsburgh Screw and Bolt Corporation has been granted a charter by the State of Pennsylvania. The new company was formed through the merger of the Pittsburgh Screw and Bolt Co., the Pittsburgh Screw and Bolt Corporation, and the Colona Manufacturing Company.

The Ottumwa (Iowa) Special Body Works was opened last week by M. L. Van Fossan, formerly of a similar concern in Battle Creek, Mich. The Ottumwa firm has been thoroughly equipped for all types of body repair work and to build special bodies on chassis.

The Pangborn Corporation, of Hagerstown, Md., has taken over the goodwill, patterns and drawings of

the Universal Shot & Sand-Blast Manufacturing Co., of Hoboken, N. J., and will manufacture Universal parts and supplies. Robert E. Donnelly and Frank G. Weber, owners of the Universal firm, are now associated with the Pangborn Corporation.

The Deep River Manufacturing Co., Deep River, Conn., has been acquired by local men. The company will reopen the plant after renovations have been made. The plant has been closed for several months and will resume the manufacture of wire goods.

The Triplex Machine Tool Co., 50 Church St., New York, N. Y., has been appointed exclusive agent in the New York territory for the Micro Machine Co., of Bettendorf, Ia., and for the Fosdick Machine Tool Co., of Cincinnati.

The Century Electric Co., of St. Louis, Mo., has located a stock of motors at Columbus, Ohio. Communications should be addressed to the Cleveland office, however, at 958 Hanna Building.

The Harry G. Masten Co., 105 W. Monroe Street, Chicago, has been appointed Chicago distributor of the Una Welding and Bonding Co., Cleveland, Ohio, manufacturer of Una welding machines and welding wire.

The American Institute of Weights and Measures has changed its address from 115 Broadway to 33 Rector St., New York City. William E. Bullock is secretary.

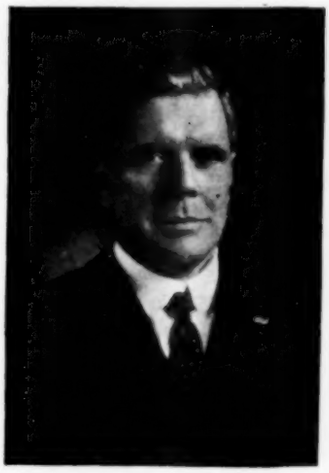
The Henry Lindahl Machine Co., Chicago, has changed its name to the Henry Lindahl Foundry and Machine Company.

Personals

LUDWELL H. GILMER, founder and chairman of the board of the L. H. Gilmer Co., of Tacony, Philadelphia, Pa., has severed his connection with that company, except as a director, to head a new corporation for the manufacture of endless belts. The new company will be known as the Gilmer Corporation and will have its headquarters in Detroit, with a factory at Auburn, Ind., where it is planned to start production on April 15. Initial production will be centered on automobile fan belts and other molded rubber products.

EDWARD L. HOLLJES has been appointed sales manager for William Sellers & Co., Inc., of Philadelphia, manufacturers of heavy machine tools and locomotive injectors. After graduation from Lehigh in 1908, Mr. Holljes took a special apprenticeship course in the shops of the Baldwin Locomotive Works and joined the Sellers company in 1909 in a sales position. He first covered the Southeast territory and later was promoted to take charge of sales in the home office, a position that he has held for a number of years.

J. C. LINCOLN, formerly president of the Lincoln Electric Co., Cleveland, has been made chairman of the board of directors, and J. F. LINCOLN, formerly vice-president, has been made president. The new president has been a prominent figure in the electrical industry since he became general manager of the company in 1912, and was one of the first to see



J. F. Lincoln
President, Lincoln Electric Co.

the possibilties of electric arc welding. When arc welding was still in its infancy he redesigned the line of motors and welders made by the company to utilize this process. Mr. J. C. Lincoln's new duties will afford him additional time to devote to research and experimental development work.

ROBERT E. YOUNG, formerly foreman of the cone grinding and reaming department of the Hartford plant of the New Departure Manufacturing Co., has been made superintendent of the ball race grinding department at Hartford.

W. A. PUBLISKY, secretary-manager of the Bowman-Boyer Co., Keokuk, Iowa, agricultural machinery firm, has resigned to become manager of sales in the wholesale department of the Red Jacket Manufacturing Co., Davenport, Iowa.

C. M. DARDEN has been promoted to assistant superintendent of machinery of the Nashville, Chattanooga & St. Louis R.R., with headquarters at Nashville, Tenn. He was formerly mechanical engineer.

LOUIS RUTHENBERG, until recently vice-president and assistant general manager of the General Motors Truck Co., has resigned to become president and general manager of the Copeland Products, Inc., also of Detroit.

J. W. HAYNES has been appointed superintendent of the France Foundry & Machine Co., Toledo, Ohio. He was formerly with the Plano (Ill.) Foundry Company.

HARRY A. GOURLEY has been appointed general superintendent of the Canonsburg (Pa.) Steel & Iron Works. He was formerly with the Michigan Steel Corporation of Detroit.

Obituaries

ALFRED MARSHALL, formerly president of the Marshall & Huschart Machinery Co., Chicago, died at Mobile, Ala., on March 24 after a brief illness. He had been in retirement for the past ten years. In 1891 he first came to Chicago as Western manager of the Prentiss Tool & Supply Co., of New York. He later bought out the Middle Western interests of this company and founded the Marshall & Huschart firm. He was widely known in the machine tool business, having represented many of the leading Cincinnati manufacturers.

RANSOM P. KETTENRING, former vice-president of the Defiance Machine Works, Defiance, Ohio, died recently after a prolonged illness. He was 65 years old.

G. FRANK HATHAWAY, manager of the Wyman-Gordon Co., Worcester, Mass., died on March 26 at his home in West Boyleston.

Forthcoming Meetings

NATIONAL METAL TRADES ASSOCIATION. Convention, Hotel Drake, Chicago, April 24-25. J. E. Nyhan, national secretary, Peoples Gas Building, Chicago, Ill.

AMERICAN WELDING SOCIETY. Annual meeting, April 24-26, at the Engineering Societies Bldg., New York. M. M. Kelly, secretary, 29 West 39th St., New York.

AMERICAN MANAGEMENT ASSOCIATION. Annual meeting, Hotel Pennsylvania, New York, May 7. W. J. Donald, managing director, 20 Vesey St., New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Eastern Spring meeting, Rochester, N. Y., week of May 13. Third national meeting of the aeronautic division, St. Louis, Mo., May 27-30. Semi-annual meeting, Salt Lake City, Utah, July 1-4. Third national meeting of the Iron and Steel Division, during the Steel Treaters' Exposition, Cleveland, September 11-13. Calvin W. Rice, secretary, 29 West 39th St., New York City.

AMERICAN GEAR MANUFACTURERS' ASSOCIATION. Thirteenth annual meeting to be held in the Hotel Statler, Cleveland, Ohio, May 16-18. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland.

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting, June 24-28, at the Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

SOCIETY OF AUTOMOTIVE ENGINEERS. Summer meeting, Saranac Inn, Upper Saranac Lake, N. Y., June 25-28. Coker F. Clarkson, manager, 29 E. 39th St., New York.

The Weekly Price Guide

Rise and Fall of the Market

THE trend in copper prices continues upward, electrolytic having advanced 2½c. per lb., since last week. Following the rise in raw material, copper tubing is up 5c. per lb. at New York warehouses. Other fabricated brass and copper products are similarly affected. In keeping with the general movement in the non-ferrous metals, the following materials advanced during the week: tin, 1c. per lb.; solder, ½c. per lb.; babbitt metal, 1c., at New York warehouses. Red and white lead rose ½c. per lb., owing to the increased cost of pig metal. Linseed oil is off 0.1c. per lb. at New York, while pig iron declined at Cincinnati, New York, Birmingham, and Chicago.

(All prices as of March 29, 1929)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$18.94
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 1.75@2.25)	24.50
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	15.50@16.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	21.26
PITTSBURGH, including freight charge ($1.75) from Valley:	
No. 2 Foundry	19.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.50
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10@2.20	3.35	3.25	3.90*
No. 12	2.15@2.25	3.40	3.30	3.95*
No. 14	2.25@2.35	3.45	3.35	4.00*
No. 16	2.35@2.45	3.55	3.45	4.10*
Black				
Nos. 18 to 20	2.65@2.75	3.60	3.40	3.80
No. 22	2.80@2.90	3.75	3.55	3.95
No. 24	2.85@2.95	3.80	3.60	4.00
No. 26	2.95@3.05	3.90	3.70	4.10
No. 28	3.10@3.20	4.50	3.85	4.25
Galvanized				
No. 10	2.80@2.90	3.95	3.75	4.05
Nos. 12 to 14	2.90@3.00	4.05	3.85	4.15
No. 16	3.00@3.10	4.15	3.95	4.25
No. 18	3.15@3.25	4.30	4.10	4.40
No. 20	3.30@3.40	4.45	4.30	4.55
No. 22	3.35@3.45	4.50	4.35	4.60
No. 24	3.60@3.70	4.65	4.45	4.75
No. 16	3.75@3.85	4.90	4.70	5.00
No. 28	4.00@4.10	5.15	4.95	5.25

*Up to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Glav.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	—Diameter in Inches— External	Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb:

— Thickness — Decimal Fractions	B.w.g. and	Outside Diameter in Inches ½	⅝	¾	⅞	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.25†	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10†	5.30	5.00
Cold drawn, round or hexagon‡	3.50	3.65	3.60
Cold drawn, flat or square‡	4.00	4.15	4.10
Structural shapes	3.30†	3.00	3.10
Soft steel bars	3.25†	3.00	3.00
Soft steel bar shapes	3.25†	3.00	3.00
Soft steel bands	3.75†	3.65	3.65
Tank plates	3.30†	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, ¾-in. thick. †Up to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ½, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			22.75
Tin, Straits, pigs, New York			52.50
Lead, pigs, E. St. Louis	7.67½	New York	8.50
Zinc, slabs, E. St. Louis	6.80	New York	8.00

	New York	Cleveland	Chicago
Antimony, slabs	12.50	13.00	14.25
Copper sheets, base	33.75	33.75	32.75
Copper wire, base	29.37½	24.50	24.87½*
Copper bars, base	32.25	32.25	31.25
Copper tubing, base	35.12½	35.12½	34.12½
Brass sheets, high, base	27.12½	27.62½	26.37½
Brass tubing, high, base	32.00	32.50	31.25
Brass rods, high, base	24.87½	25.37½	24.12½
Brass wire, high, base	27.62½	28.12½	26.37½

*At mill.

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25.00*	24.30	24.30
Zinc sheets (casks).....	10.00@10.50	11.70	10.11
Solder (½ and ½).....	35.25	34.00	31@34
Babbitt metal, delivered in case lots, New York, cents per lb:			
Genuine, highest grade.....			70.00
Commercial genuine, intermediate grade.....			54.00
Anti-friction metal, general service.....			31.50
No. 4 babbitt (f.o.b.).....			12.75

*Delivered.

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va:

	Nickel	Monel Metal
Sheets, full finished.....	52.00	42.00
Sheets, cold rolled.....	60.00	50.00
Strip, cold rolled.....	55.00	45.00
Rods, hot rolled.....	45.00	35.00
Rods, cold rolled.....	53.00	40.00†
Tubing.....	75.00*	90.00
Angles, hot rolled.....	50.00	40.00
Plates.....	52.00	42.00

*Seamless. †Cold drawn.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity offered for sale:

	New York	Cleveland	Chicago
Crucible copper.....	20.50 @21.00	15.25	18.00 @18.50
Copper, heavy, and wire..	19.00 @20.50	14.75	17.00 @17.50
Copper, light, and bottoms	17.25 @17.75	12.50	16.00 @16.50
Heavy lead.....	6.50 @ 7.00	6.25	6.00 @ 6.50
Tea lead.....	5.25 @ 5.50	4.25	5.00 @ 5.50
Brass, heavy, yellow.....	11.75 @12.25	10.00	11.00 @11.50
Brass, heavy, red.....	.....	12.75	15.50 @16.00
Brass, light.....	9.50 @10.00	8.25	10.00 @10.50
No. 1 yellow rod turnings.	12.25 @12.75	10.50	12.00 @12.50
Zinc.....	3.50 @ 4.00	3.25	3.25 @ 3.75

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20.....	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20.....	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20.....	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.†.....	.16	38.00 per M	.16
Sal soda, per lb.....	.02	.02	.02
Roll sulphur, per lb.....	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.109	.11	.114
Cutting oil, about 25% lard, in 5 gal. cans, per gal.....	.55	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal..	.33	.36	.35
Belting — Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin. ft., per inch of width, for single ply:			
Medium grade.....	30–10%	30–10%	35%
Med. grade, heavy wgt...	30– 5%	30– 5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60– 5%	50–10%

*All waste in bale lots. †100-lb. bales.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb..	$0.0325	$0.0325	$0.0324
Cold drawn shafting...	per lb..	.035	.035	.034
Brass rods.....	per lb..	.2487½	.205	.165
Solder (½ and ½).....	per lb..	.3525	.3475	.34
Cotton waste, white...	per lb..	.10@.13½	.10@.13½	.10@.13½
Disks, aluminum oxide mineral, cloth, No. 1, 6-in. dia.....	per 100.	3.60	3.59	3.10
Lard cutting oil.....	per gal.	.55	.55	.65
Machine oil.....	per gal.	.33	.30	.27
Belting, leather, medium.....	off list..	30–10%	30–10%	35%
Machine bolts, up to 1x30 in., full kegs...	off list..	50-10%*	50–10%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper.....	$4.50	$4.29	$4.29
Emery cloth.....	22.93	20.97	20.97
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper.....	2.64	2.04	2.04
Cloth.....	3.60	3.59	3.59
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton...	Connellsville,		2.75@2.85
Coke, prompt foundry, per net ton...	Connellsville,		3.75@4.50
White lead, dry or in oil...	100 lb. kegs....	New York,	13.75
Red lead, dry.....	100 lb. kegs....	New York,	13.75
Red lead, in oil.....	100 lb. kegs....	New York,	15.25

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less.....	60%
Larger, up to 1 x 30-in., full kegs, list less.....	50–10%
Less than full kegs or case lots, add to list.....	10%
Fitting-up bolts: list less.....	45%
Lag screws:	
Up to ½-in. x 6-in., list less.....	60%
Larger, list less.....	50–10%
Less than full keg or case lots, add to list.....	10%
Rivets:	
Structural, round head, full kegs, net.....	$4.50
Structural, round head, broken kegs, net.....	6.00
Tank, 7–16-in. dia. and smaller, list less.....	60%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less.....	60%
Larger, up to 3-in., list less.....	40–10%
Less than keg or case lots, add to list.....	10%
Washers:	
Wrought, full kegs, per 100 lb., list less.....	$4.00
Wrought, broken kegs, per 100 lb., list less.....	2.00
Turnbuckles:	
With stub ends list less.....	20%
Without stub ends, list less.....	50%
Chain:	
Proof coil, base, per 100 lb., net.....	$7.10
Cast iron welding flux, per lb., net.....	.40
Brazing flux, per lb., net.....	.80

Machine Requirements and Industrial Construction

Equipment Wanted

Calif., Los Angeles—Conveyor Co., 129 Llewellyn St.—5 ton crane for proposed 1 story, 100 x 120 ft. factory. Estimated cost $100,000.

Ill., Streator—Anthony Co.—3 to 5 ton overhead electric crane, 50 ft. span.

Ind., Anderson—Maring Wire Co., 31st and Noble Sts.—machinery and equipment for proposed remodeling of plant. Estimated cost $15,000.

Ind., Anderson—Van Loon Pattern Co., 16th and Jackson Sts.—machinery and equipment for recently acquired plant. Estimated cost $10,000.

Md., Baltimore—Port Development Commission, Bd. of Awards—will receive bids until Apr. 10 for three electrically operated semi-portal gantry cranes, etc., for McComas St. terminal improvements.

Mich., Detroit—Michigan Smelting & Refining Co., 7885 Joseph Campau Ave. — equipment for proposed 1 story, 150 x 300 ft. addition to smelting works. Estimated cost $125,000.

O., Akron—W. E. Wright Co., 451 South Main St.—four locomotive cranes.

O., Oakley (br. Cincinnati)—Cincinnati Milling Machinery Co.—20 ton crane for proposed 1 story, 140 x 250 ft. assembly and shipping building. Estimated cost $125,000.

Pa., Braeburn — Braeburn Alloy Steel Corp.—1,500 lb. guided ram steam hammer.

Tex., Denison—W. J. Smith Wood Preserving Co.—machinery and equipment for proposed plant. Estimated cost $75,000.

Tex., San Antonio—T. H. Etheridge, Jr., 230 Broadway—woodworking equipment to handle cedar timber, for proposed development.

Alta., Edmonton—Waterous Ltd., Brantford, Ont., C. A. Waterous, Gen. Mgr. — machinery and equipment for the manufacture of boilers, engines, farm machinery, road rollers, pulp and paper machinery, etc., for recently acquired plant. Estimated cost $100,000.

Man., Brandon—A. H. MacDonald Sash Door Co.—complete equipment to replace fire loss. $100,000.

Ont., North Bay—Bd. of Education, D. H. Hamilton, 178 Worthington St. E., Chn. —machinery and equipment for woodworking and machine shops, etc., for proposed vocational high school. $200,000.

Ont., Orillia—E. Long Co. Ltd., F. Smith, Mgr.—equipment for the manufacture of mining machinery for proposed addition to plant. Estimated cost $25,000.

Ont., Toronto — Canadian Ornamental Iron Co. Ltd., 88 River St.—machinery and equipment for proposed addition to plant.

Opportunities for Future Business

Calif., Eureka—State Highway Commission, G. B. McDougal, Public Works Bldg., Sacramento, Archt., is receiving bids for a group of buildings including two maintenance shops, etc., here. Estimated cost $80,000. Noted Oct. 25, 1928.

Calif., Fruitvale—United Filters Corp., Hazleton Heights, Hazleton, Pa., is having preliminary plans prepared for the construction of a factory at 4th and Madison Sts. here. Estimated cost $500,000.

Calif., Inglewood—Moreland Aircraft Co., c/o Austin Co. of California, 77 East Washington St., Los Angeles, awarded contract for a 1 story, 120 x 180 ft. factory near Mines field. Noted Jan. 31.

Calif., Los Angeles — Safety Elevator Corp., 2123 South Los Angeles St., plans the construction of a factory. Estimated cost $40,000. J. M. Cooper, Marsh-Strong Bldg., Archt.

Calif., Oakland — Aluminum Cooking Utensil Co., 45th and Adeline Sts., awarded contract for a 2 story factory. Estimated cost $41,986.

Conn., Bridgeport—City Lumber Co., I. Schine, Pres., Third and Charlotte Sts., plans the construction of a wood planing mill and warehouses at Seaview Ave. Estimated cost $40,000. Architect not selected.

Conn., Derby — Hershey Metal Products Co., c/o Kinne & Palmer, 256 Main St., Archts., is receiving bids for a 1 story, 60 x 100 ft. factory. Estimated cost $40,000.

Conn., New Britain—New Britain Tool Mfg. Co., C. A. Carlson, Pres., 10 Harvard St., is having plans prepared for a 2 story, 50 x 100 ft. factory on Harvard St. Estimated cost $40,000.

Ill., Chicago — American Electric Fusion Corp., 2610 Diversey Ave., awarded contract for a 2 story, 44 x 180 ft. factory. Estimated cost $20,000.

Ill., Chicago—A. Epstein, 2001 West Pershing Rd., Archt., will soon receive bids for a 1 story factory at Pershing Rd. and Crawford Ave. for Standard Stamping & Perforating Co., 4718 5th Ave.

Ind., Indiana Harbor (mail East Chicago) —Inland Steel Co., 38 South Dearborn St., Chicago, Ill., plans the construction of a car mill, jobbing mill, etc., here.

Md., Baltimore—G. L. Martin Co., Colgate, is receiving bids for a 1 story, 302 x 903 ft. aircraft factory here. Estimated cost $1,500,000. P. L. Small & Associates, 1836 Euclid Ave., Cleveland, O., Archts.

Mass., Chelsea — International Pipe & Mining Co., H. Kennedy, Pres., 475 5th Ave., New York, N. Y., plans the construction of a plant on Eastern Ave. Estimated cost $3,000,000.

Mass., East Boston (Boston P. O.) — Bethlehem Shipbuilding Corp., 100 Milk St., Boston, is receiving bids for a 1 story, 90 x 225 ft. machine shop at 80 Border St., here. Estimated cost $60,000. H. W. Bisbee, Cole Rd., Hingham, Archt. Noted Mar. 7.

Mass., Quincy (Boston P. O.)—Bethlehem Shipbuilding Corp., S. W. Walkeman, 97 East Howard St., is receiving bids for a 2 story addition to joiner shop. H. W. Bisbee, c/o owner, Archt.

Mich., Bridgman—Mathieu & Sons Foundry Co., plans the construction of a 1 story, 60 x 240 ft. foundry. Estimated cost $70,000. W. Fett, South Bend, Ind., Engr.

Mich., Detroit—Ex-Cell-O Tool & Mfg. Co., 1200 Oakman Blvd., awarded contract for a 1 and 2 story, 74 x 186 ft. addition to factory. Estimated cost $45,000.

Mich., Flint — Marvel Carburetor Co., awarded contract for the construction of a 1 story factory. Estimated cost $55,000. Private plans.

Mont., Laurel—Northern Pacific Ry. Co., Railroad Bldg., St. Paul, Minn., will soon award contract for the construction of 100 x 250 ft. car repair shops, here. Estimated cost $100,000. H. E. Stevens, Ch. Engr.

Neb., Lincoln—Bd. of Education, c/o J. G. Ludlam, Secy., plans the construction of a 3 story, 135 x 200 ft. maintenance building at 23rd and Randolph Sts. Estimated cost $170,000. E. Davis, 525 South 13th St., Archt.

N. J., Camden—Rundle Mfg. Co., 27th St. and Cleveland Ave., Milwaukee, Wis., awarded general contract for a 150 x 330 ft. foundry, 100 x 180 ft. enameling plant, 100 x 140 ft. warehouse, etc. Estimated

N. J., Newark—Sonatron Tube Co., 57 State St., is receiving bids for a 6 story, 68 x 120 ft. factory at 78-82 8th Ave. Estimated cost $175,000. Siegler & Greenberg, 164 Market St., Archts. Noted Feb. 21.

N. Y., New York—Michall Mangiamele, 868 East 219th St., plans a 1 story, 95 x 100 ft. garage at Appleton and Buhre Ave. Estimated cost $40,000. F. J. Ross, 4200 White Plains Ave., Archt.

N. Y., Port Washington — American Aeronautical Corp. awarded contract for the design and construction of a 150 x 580 ft. air terminal on Manhasset Isle, near here.

O., Canton — Macomber Steel Co., 1925 10th St., N. E., plans the construction of a 1 story, 76 x 188 ft. factory at 2020 10th St. Estimated cost $40,000.

O., Cleveland—Electric Vacuum Cleaner Co., J. Tuteur, Pres., 1734 Ivanhoe Rd., awarded contract for a 1 story, 80 x 125 ft. factory. Estimated cost $50,000.

O., Cleveland—Hupp-Chandler Corp., East 131st St., St. Clair Ave., had plans prepared for a 1 story, 96 x 450 ft. factory on East 131st St. Estimated cost $250,000. E. McGeorge, 3030 Euclid Ave., Archt.

O., Cleveland—Scott & Fetzer Co., 11401 Locust Ave., manufacturers of vacuum cleaners, is receiving bids for a 2 story, 50 x 216 ft. addition to factory on West 114th St. and Locust Ave. Estimated cost $70,000. A. C. Wolf, Swetland Bldg., Archt. Noted Mar. 28.

O., Cleveland—Thompson Products Co., C. E. Thompson, Pres., 2196 Clarkwood Rd., manufacturers of automobile and airplane parts, awarded contract for a 4 story, 72 x 106 ft. addition to factory. Estimated cost $150,000. Noted Mar. 21.

O., Dayton—National Cash Register Co., Main and K Sts., awarded contract for a 6 story factory. Estimated cost $800,000.

Okla., Tulsa—Wackman Welded Ware Co., 7th and Victor Sts., St. Louis, Mo., is having preliminary plans prepared for the construction of a steel barrel factory here. Estimated cost $100,000. Private plans.

Ore., Empire—Sitka Spruce & Pulp Co., C. M. Johnson, Mgr., plans the construction of a sawmill. Estimated cost $40,000 to $50,000.

Pa., Bristol—Keystone Aircraft Corp., plans a 100 x 250 ft. addition to factory. Estimated cost $250,000.

Pa., Johnsonburg—Tru-tone Co., c/o J. I. Kinnear, Ridgeway, Archt., will build a 2 story, 80 x 120 ft. radio tube factory on Market St. here. Estimated cost $40,000.

Pa., Pittsburgh—Pittsburgh Gray Iron Foundry Co., South Shore and Walker Sts., awarded contract for a 1 story, 32 x 154 ft. addition to foundry. Estimated cost $80,000. Noted Mar. 7.

Pa., Rouseville — Rouseville Cooperage Co., awarded contract for a 1 story, 100 x 200 ft. barrel factory. Estimated cost $150,000. Noted Mar. 28.

Pa., Vandergrift—American Sheet & Tin Plate Co., Frick Bldg., Pittsburgh, will build a 1 story, 80 x 600 ft. machine shop and warehouse here. Estimated cost $150,000. G. C. Kimball, c/o owner, Engr.

Tenn., Elizabethtown—Watwauga Steel & Construction Co., Nashville, recently organized, plans the construction of a plant here.

Tex., Texarkana — Southwestern Transportation Co., W. A. Taussig, Supt., subsidiary of St. Louis, Southwestern Ry. Co., Tyler, plans the construction of shops, here. Estimated cost $250,000.

Wis., Milwaukee—A. O. Smith Corp., 27th and Keefe Sts., manufacturers of pressed steel products, awarded contract for a 100 x 300 ft. factory. E. W. Burgess, c/o owner, Engr.

Ont., Dundas — Brass Specialty Co., Hamilton, plans the construction of a plant here.

Ont., Walkerville—Chrysler Corp., plans the construction of second unit of automobile plant. Estimated cost $1,500,000. Hutton & Sauter, 6 Hughson St. S., Hamilton, Archts.

Ont., Walkerville—Dominion Forge & Stamping Co., Walker Rd., awarded contract for a 1 story addition to plant. Estimated cost $90,000.

Que., Hull—Hull Match Co. Ltd. is having plans prepared for the construction of a factory on St. Penfleur St. Estimated cost $100,000.